CLAIMS

1. Rail-switching unit (RSU), comprising:

- rotatable set of components called rotatable ensemble (RE),

- and a stationary set of components called stationary set (SS);

the rotatable ensemble (RE) further comprising:

- a rotatable hub (RH),
- a set of two, three or more switch-rails (SWRO, SWR1, SWR2, etc.) at least two of them (SWR1, SWR2) with a curved shape,
- a set of auxiliary components (AC1, AC2, AC3, etc.) to facilitate attachment of the switch-rails to the rotatable hub and/or to optimize the physical attributes of the rotatable ensemble and/or to facilitate precise control of the rotational movement of the rotatable ensemble;

the stationary set (SS) further comprising:

- one main fixed-rail (MFR),
- a set of two, three or more branch fixed-rails (BFRO, BFR1, BFR2, etc.),
- a supporting structure (ST);

wherein the main fixed-rail is solidly fixed to a standard stationary rail called common-rail (CR) at the external end of the main fixed-rail (eMFR) or end of the main fixed-rail that is furthest in distance from the rotatable ensemble and opposite to the internal end of the main fixed-rail (iMFR);

wherein the branch fixed-rails are solidly fixed to common-rails (CR) at their external ends of the branch fixed-rails (eBFRO, eBFR1, eBFR2, etc.) or ends of the branch fixed-rails that are furthest in distance from the rotatable ensemble and that are opposite to the internal ends of the fixed-rails (iBFRO, iBFR1, iBFR2, etc.);

wherein the number of switch-rails is equal to the number of branch fixed-rails;

wherein each of the switch-rails (SWRO, SWR1, SWR2, etc.) is configured to allow its activation or engagement into a stationary operative position called active position of alignment and/or connection with a corresponding branch fixed-rail (BFRO, BFR1, BFR2, etc.)

wherein activation of any one of the switch-rails (SWR0 or SWR1 or SWR2, etc.) involves aligning and/or connecting a so called main end (mSWRO or mSWR1 or mSWR2, etc. respectively) with the internal end of the main fixed-rail (iMFR) and aligning and/or connecting a so called branch end (bSWRO or bSWR1 or bSRW2, etc. respectively) with the corresponding internal end (iBFRO or iBFR1 or iBFR2, etc. respectively) of a corresponding branch fixed-rail (BFRO, BFR1, BFR2, etc.

respectively);

wherein each of the switch-rails is fixedly attached at a distance from an axis of rotation (Ax) of the rotatable hub (RH) so that rotational movement (Rot) of the rotatable hub about the axis of rotation allows selective activation of each of the switch-rails with a corresponding fixed-rail;

wherein the planes containing the rail path-lines of the curved switch-rails (SWR1, SWR2) are parallel to each other and to the axis of rotation (Ax) and equidistantly distanced from said axis;

and wherein the main-end furthest points of the switch-rails (FP) of each of the switch-rails (SWRO, SWR1, SWR2, etc.) are equidistantly offset from the axis of rotation (Ax) at a distance (D) not exceeding four times the widest of the main-end widths (Wi) of said switch-rails.

2. The rail-switching unit of claim 1,

wherein said rail-switching unit (RSU) is configured to bi-directionally convey or guide vehicles through the rail-switching unit either from the main fixed-rail (MFR) into any of the branch fixed-rails (BFRO, BFR1, BFR2, etc.) or from any of the branch fixed-rails (BFRO, BFR1, BFR2, etc.) into the main fixed-rail (MFR), or simultaneously allowing both directions of movement.

3. The rail-switching unit of any of the previous claims,

Wherein the main fixed-rail (MFR) and the switch-rails (SWR0 or SWR1 or SWR2, etc.) are shaped and/or configured to allow engagement between the internal end of the main fixed-rail (iMFR) and any of the main ends of the switch-rails (mSWRO, mSWR1, mSWR2, etc.) by means of mating profiles at main ends or main mating profiles (MMPO, MMP1, MMP2, etc.)

and/or wherein the branch fixed-rails and the switch-rails are shaped and/or configured to allow engagement between the internal ends of the branch fixed-rails (iBFRO, iBFR1, iBFR2, etc.) and the corresponding branch ends of switch-rails (bSWRO, bSWR1, bSWR2, etc. respectively) by means of mating profiles at branch ends or branch mating profiles (BMP1, BMP2, BMP3, etc.);

wherein a main mating profile (MMPO, MMP1, MMP2, etc.) comprises

- a main mating surface called female (fMMS) that is present on the internal end of the main fixed-rail (iMFR),
- and a main mating surface called male (mMMSO, mMMS1, mMMS2, etc.) that matches the female surface (fMMS) and that can be present on any of the main ends of the switch-rails (mSWRO, mSWR1, mSWR2, etc. respectively);

wherein a branch mating profile (BMPO, BMP1, BMP2, etc.) comprises

- a branch mating surface called female (fBMSO, fBMS1, fBMS2, etc.), present on any of the internal ends of the branch fixed-rails (iBFRO, iBFR1, iBFR2, etc.);
- and a branch mating surface called male (mBMS) that matches a corresponding female surface (fBMSO, fBMS1, fBMS2, etc.), and that can be present on any of the branch ends of the switch-rails (fSWRO, fSWR1, fSWR2, etc. respectively);

wherein a branch or main mating surface that is called female (fMMS or fBMS) does not necessarily have to be mainly concave and a branch or main mating surface that is called male (mMMS or mBMS) does not necessarily have to be mainly convex;

and wherein the matting profiles are configured to allow firm connection between switch-rails and fixed-rails and configured to facilitate smooth movement of the switch-rails into and out of their positions of engagement with corresponding fixed-rails.

4. The rail-switching unit of claim 3,

wherein at least one of the mating profiles is designed and configured to facilitate halting the continuity of the rotational movement of the rotatable ensemble when a certain active position of a switch-rail has been reached, to facilitate maintaining the reached active position of the switch-rail, and to facilitate the reversal of the direction of the rotational movement of the rotatable ensemble in order to come out of the reached active position of the switch-rail;

and/or wherein at least one of the mating profiles is configured to facilitate smooth and controlled movement of the switch-rails into and out of their active positions of engagement with the corresponding branch fixed-rails preferably by means of specific shapes of the male and female mating surfaces and/or by means of using one or more sets of mating profile bearings (MPB1, MPB2, MPB3, etc.), these preferably being sets of bearings and/or other auxiliary mechanisms to reduce friction and/or control relative movement between surfaces which are integrated with one or both of the mating surfaces.

5. The rail-switching unit of any of the previous claims,

wherein the set of switch-rails consists of

- a switch-rail with a basically straight shape and called straight switch-rail (SWR0),
- a first switch-rail with a basically curved shape and called first curved switch-rail (SWR1),
- and a second switch-rail with a basically curved shape and called second curved switch-rail (SWR2);

wherein the set of branch fixed-rails consists of

- a fixed-rail shaped and/or configured to be connected with the straight switch-rail and called straight-path branch fixed-rail (BFR0),
- a fixed-rail shaped and/or configured to be connected with the first curved switch-rail and called first curved-path branch fixed-rail (BFR1),
- and a fixed-rail shaped and/or configured to be connected with the second curved switch-rail and called second curved-path branch fixed-rail (BFR2);

wherein when the straight switch-rail is rotated into active position, it engages simultaneously on a main end with the main fixed-rail and on a branch end with a corresponding straight-path branch fixed-rail;

wherein when the first curved switch-rail is rotated into active position, it engages simultaneously on a main end with the main fixed-rail and on a branch end with a corresponding first curved-path branch fixed-rail;

wherein when the second curved switch-rail is rotated into active position, it engages simultaneously on a main end with the main fixed-rail and on a branch end with a corresponding second curved-path branch fixed-rail;

wherein all engagements between switch-rails and corresponding fixed-rails have the purpose of providing a continuous running surface and/or a continuous connection between the switch-rail and the corresponding fixed-rail in a bidirectional way (in one direction, in the other direction, or in both directions);

6. The rail-switching unit of any of the previous claims,

wherein the first curved switch-rail and the second curved switch-rail have different curvature profiles.

7. The rail-switching unit of any of the previous claims,

further comprising

- an actuator arrangement to provide and transmit the necessary drive for the rotational movement of the rotatable ensemble;

wherein the actuator arrangement may be able to actuate on only one rotatable ensemble or simultaneously on two or more rotatable ensembles of different rail-switching units.

8. The rail-switching unit of any of the previous claims,

further comprising

- a mechanism to block angular positions of the rotatable ensemble, named position-blocking mechanism (PBM, not shown in drawings), to assure and/or reaffirm precision and solidness of the engagement between switch- rails and fixed-rails by allowing firm, fast and timely blocking and unblocking of the rotatable ensemble by means of a multi-point latch mechanism operated by a control system and/or mechanically linked with the angular movement of the rotatable hub;

wherein the position-blocking mechanism (PBM) may be able to operate on only one rotatable ensemble or on two or more rotatable ensembles of different rail-switching units.

9. The rail-switching unit of any of the previous claims,

further comprising

- an engagement-guiding system (EGS) with the purpose of providing controlled rotational movement of the rotatable hub and the switch-rails during transitional phases, and/or of accurately guiding the ends of the switch-rails into precise and/or smooth engagement with their corresponding ends of the fixed-rails.

10. The rail-switching unit of claim 9,

wherein the engagement-guiding system comprises:

- a set of one or more stationary engagement guides (SEG1, SEG2, etc.),
- a set of one or more engagement-guiding bearings (EGB1, EGB2, etc.),
- and a set of one or more rotatable engagement components (REC1, REC2, etc.);

wherein the engagement-guiding bearings, which are preferably cylindrical roller bearings or needle roller bearings and/or any other auxiliary mechanisms to reduce friction and/or control relative movement between surfaces, are configured to facilitate the interaction between stationary surfaces of the stationary engagement guides and moving surfaces of the rotatable engagement components to accurately control their relative motion

and/or to reduce the potential friction and constrain between them, with the ultimate objective of achieving a fast, smooth and precise engagement between switch-rails and corresponding fixed-rails;

and wherein the rotatable engagement components provide surfaces to interact with the stationary engagement guides directly or by means of engagement-guiding bearings, are solidly fixed to the rotatable ensemble, integrate with the rotatable hub and/or the switch-rails and/or the auxiliary components, and may integrate with mating profile surfaces at the ends of the switch-rails.

11. The rail-switching unit of claim 10,

wherein the set of stationary engagement guides comprises:

- one or more stationary engagement guides placed in outermost rings and presenting guiding surfaces with inward curving - called concave guiding surfaces (CNC),
- and/or one or more stationary engagement guides placed in innermost rings and presenting guiding surfaces with outward curving - called convex guiding surfaces (CNV);

wherein the concave or convex guiding surfaces do not necessarily have to be continuous, and if so, they have the general shape of an arch covering up to approximately 180 degrees;

wherein the concave or convex guiding surfaces are fundamentally concentric and share the same axis of rotation of the rotatable hub;

and wherein the concave or convex guiding surfaces that are adjacent to an internal end of a branch fixed-rail are solidly fixed to it and configured to allow smooth and precise engagement of the end of the switch-rail (and its mating profile if present) with the corresponding end of the fixed-rail (and its mating profile if present).

12. The rail-switching unit of claim 11,

Wherein, with the purpose of minimizing slacks, facilitating deceleration of the rotational movement of the rotational ensemble, and thus improving the final speed and accuracy of the connections between fixed-rails and switch-rails when reaching active positions,

at least one of the concave guiding surfaces (CNC) has a curvature profile with a curvature radius that is slightly and progressively reduced at one or both end sections of the stationary engagement guide (bCNC and bCNC') and/or at the mid-section of the stationary engagement guide (mCNC),

and/or at least one of the convex guiding surfaces (CNV) has a curvature profile with a curvature radius that is slightly and progressively increased at one or both end sections of the stationary engagement guide (bCNV and bCNV') and/or at the mid-section of the stationary engagement guide (mCNV).

13.The rail-switching unit of claims 11 or 12,

wherein at least one rotatable engagement component is shaped integrating the matching profiles of different branch ends of switch-rails and providing surfaces that allow simultaneous interaction with a concave guiding surface and with a convex guiding surface.

14.The rail-switching unit of any of the previous claims,

wherein the rail-switching unit (RSU) is configured with the internal branch ends of the branch fixed-rails (iBFRO, iBFR1, iBFR2, etc.) separated at fixed distances between each other providing necessary clearance spaces for the vehicles to be directed avoiding inadequate interferences through the rail-switching unit (RSU);

wherein the rail-switching unit (RSU) is suitable for use in systems where vehicles run along tracks and have rail-interacting components that interact with top, lateral and/or bottom sides of the rails.

15. The rail-switching unit of any of the previous claims,

wherein the rail-switching unit is configured so that the internal branch ends of the branch fixed-rails (iBFRO, iBFR1, iBFR2, etc.) do not necessarily have to form a plane and, if so, the plane they form does not necessarily have to be of horizontal nature.

16. The rail-switching unit of any of the previous claims,

wherein the set of auxiliary components (AC1, AC2, etc.) to optimize the physical attributes of the rotatable ensemble and/or to facilitate precise control of the rotational movement of the rotatable ensemble, comprises a variety of plates made out of a material of higher specific weight than that of the switch-rails (SWRO, SWR1, SWR2, etc.);

wherein said plates are placed attached outside or inside the rotatable hub (RH), the bodies of said switch-rails or the bodies other auxiliary components without affecting neither rotary movements (Rot) of said rotatable ensemble (RE) nor vehicle movements along vehicle-interacting surfaces of said switch-rails;

wherein said plates are shaped along their longitudinal distances with progressively augmenting or diminishing cross-sectional areas to specifically compensate the gradual displacement of the bodies of the diverging switch-rails and their supporting auxiliary components relative to the axis of rotation

(Ax) and/or to specifically compensate the gradual necessary/unnecessary compensation of a straight switch-rail (SWRO) relative to curved switch-rails placed at opposed sides from the axis of rotation (Rot).

17.Track-switching unit (TSU),

for use to allow controlled and selective switching of a segment of a track or guideway;
the track-switching unit comprising:

- one or more rail-switching units (RSU1, RSU2, etc..) of the previous claims,
- a set of components linked to or part of an electronic operating control system (OCS),
- a supporting structure (TSU-ST);

wherein the number of rail-switching units is equal to the number of rails that compose the track segment affected by the track-switching unit;

wherein the track-switching unit is configured so that the internal branch ends of the branch fixed-rails (iBFRO, iBFR1, iBFR2, etc.) of the rail-switching units (RSU1, RSU2, RSU3, etc.) do not necessarily have to form a plane and, if so, the plane they form is not necessarily of horizontal nature;

wherein when comprising more than one rail-switching unit and in their normal 20 operating mode, the rail-switching units are meant to be operated in a simultaneous way, but not necessarily by means of

mechanical links between them, and not necessarily in a precise synchronous manner;

wherein when comprising more than one rail-switching unit and in their normal operating mode, the rail-switching units are meant to be operated congruently to create viable paths of continuity for the vehicles to move along the track;

and wherein the supporting structure (TSU-ST) solidly supports, consolidates and protects elements comprised within the track-switching unit (TSU) and, if appropriate, also firmly attaches them to the ground and/or to the common guideway structures or integrates them with the supporting structures of the rail-switching units.

18. The track-switching unit of claim 17,

wherein the track-switching unit (TSU) is configured to switch rails that are supported from the outer laterals of the track, leaving top and bottom and/or inner-lateral surfaces of said rails free for vehicles to interact with them when conveyed through the guideway;

19. The track-switching unit of claim 18,

wherein the distance between two rails of a bi-railed track (HGAP) and the width of the vehicle body (wVB) defined as not including the rail-interacting components of the vehicle are adapted to each other to allow that the whole width of the vehicle body (wVB), when the vehicle is directed through a track-switching unit (TSU) for a switch-point where tracks diverge or converge vertically, is able to fit within the horizontal gap between two rails of a same

track (HGAP) and pass through the track-switching unit (TSU) without any inadequate interferences.

20. The track-switching unit of any of prior claims 17-19,

wherein the track switching unit (TSU) and the vehicles passing through it are adapted to each other to provide minimal clearance gaps above and below the rails (tvGAP and bvGAP) allowing sufficiently-safe passing-through of the top and bottom rail-interacting components of the vehicles.

21. The track-switching unit of any of prior claims 17-20,

wherein the tracks in diverging/merging points are progressively vertically distanced /approximated avoiding any lateral turns of the tracks in a portion of the guideway called straight-guideways segment (SGS) that is linked to the branch fixed-rails and thus is adjacent to the track-switching unit (TSU).

22. The track-switching unit of any of prior claims 17-21,

wherein the longitudinal length of straight-guideways segments (ISGS) is reduced by means of minimizing the top height of the vehicle body (thVB) and/or minimizing the bottom height of the vehicle body (bhVB).

23. The track-switching unit of any of prior claims 17-22,

wherein the track-switching unit (TSU) and the segments of guideway adjacent to the track-switching unit (TSU) and/or the general common guideway and/or vehicles running through the track-switching unit (TSU) are adapted to each other to assure full clearance of passing-vehicles.

~~24. Track-switching system (TSS),~~

~~for use to allow coordinated and controlled selective switching of multiple track segments of a vehicle-guiding system (VGS),~~

~~comprising:~~

- ~~one or more track-switching units (TSUI , TSU2, TSU3, etc..) of prior claims 17-23,~~
- ~~an electronic operating control system (OCS),~~
- ~~and a supporting structure (TSS-ST);~~

~~wherein the electronic operating control system manages the one or more said track-switching units, including activating, coupling, verifying, maintaining and controlling the functioning of the track-switching units and their rail-switching units;~~

~~and wherein the supporting structure (TSS-ST) solidly supports, consolidates and protects elements comprised within the track-switching system (TSS) and, if appropriate, also firmly attaches them to the ground and/or to the common guideway structures or integrates them with the supporting structures of the track-switching units.~~

1. Rail-switching unit (RSU),

for use to switch only one rail segment at a time, functioning either singly in a track-switching unit of a mono-railed track or combined with other same units in a track-switching unit of a multi-railed track;

the rail-switching unit (RSU) comprising:

- a rotatable set of components called rotatable ensemble (RE),
- and a stationary set of components called stationary set (SS);

the rotatable ensemble (RE) further comprising:

- a rotatable hub (RH),
- a set of two, three or more switch-rails (SWR0, SWR1, SWR2, etc.) at least two of them (SWR1, SWR2) with a curved shape,
- a set of auxiliary components (AC1, AC2, AC3, etc.) to facilitate attachment of the switch-rails to the rotatable hub and/or to optimize the physical attributes of the rotatable ensemble and/or to facilitate precise control of the rotational movement of the rotatable ensemble;

the stationary set (SS) further comprising:

- one main fixed-rail (MFR),
- a set of two, three or more branch fixed-rails (BFR0, BFR1, BFR2, etc.),
- a supporting structure (ST) that solidely supports, consolidates and protects elements comprised within the rail-switching unit (RSU) and firmly attaches said main and/or branch fixed-rails to the ground and/or to common guideway structures;

wherein the main fixed-rail is solidely fixed to a standard stationary rail called common-rail (CR) at the external end of the main fixed-rail (eMFR) or end of the main fixed-rail that is furthest in distance from the rotatable ensemble and opposite to the internal end of the main fixed-rail (iMFR);

wherein the branch fixed-rails are fixed to common-rails (CR) at their external ends of the branch fixed-rails (eBFR0, eBFR1, eBFR2, etc.) or ends of the branch fixed-rails that are furthest in distance from the rotatable ensemble and that are opposite to the internal ends of the branch fixed-rails (iBFR0, iBFR1, iBFR2, etc.);

wherein the number of switch-rails is equal to the number of branch fixed-rails;

wherein each of the switch-rails (SWR0, SWR1, SWR2, etc.) is configured to allow its activation, viz. engagement into a stationary operative position called active position of alignment, and/or connection with a corresponding branch fixed-rail (BFR0, BFR1, BFR2, etc.);

wherein each of the switch-rails is fixedly attached at a distance from an axis of rotation (Ax) of the rotatable hub (RH) so that rotational movement (Rot) of the rotatable hub about the axis of rotation allows selective activation of each of the switch-rails with a corresponding fixed-rail;

wherein activation of any one of the switch-rails (SWR0, SWR1, SWR2, etc.) involves aligning and/or connecting a so called main end (mSWR0, mSWR1, mSWR2, etc.) respectively) with the internal end of the main fixed-rail (iMFR) and aligning and/or connecting a so called branch end (bSWR0, bSWR1, bSRW2, etc.) respectively) with the corresponding internal end (iBFR0, iBFR1, iBFR2, etc.) respectively) of a corresponding branch fixed-rail (BFR0, BFR1, BFR2, etc.) respectively) with the purpose of bi-directionally conveying or guiding vehicles through the rail-switching unit, this is, either from the main fixed-rail (MFR) into any of the branch fixed-rails (BFR0, BFR1, BFR2, etc.), or from any of the branch fixed-rails (BFR0, BFR1, BFR2, etc.) into the main fixed-rail (MFR), or simultaneously allowing both directions of movement;

wherein the internal ends of the branch fixed-rails (iBFR0, iBFR1, iBFR2, etc.) are separated at fixed distances between each other providing the necessary gap clearance spaces for rail-wrapping assemblies (WA) of vehicles to be adequately guided without interferences through the rail-switching unit;

wherein the internal ends of the branch fixed-rails (iBFR0, iBFR1, iBFR2, etc.) do not necessarily have to form a plane and, if so, the plane they form does not necessarily have to be of horizontal nature;

wherein the rotatable ensemble is configured in a compact way to optimize its physical attributes of volume, mass, solidness and/or moment of inertia about the axis of rotation, characterized in that:

- the planes containing the rail curved-paths of the at least two curved switch-rails (SWR1, SWR2) are parallel to each other and to the axis of rotation (Ax) and equidistantly distanced from said axis;
- a straight switch-rail (SWR0) has a rail path that is straight and parallel to the axis of rotation (Ax) and the branch end (bSWR0) of said straight switch-rail is located at the side that, relative to the axis of rotation (Ax), is opposite from the side at which the branch ends of the two curved switch-rails (bSWR1, bSWR2) are located;
- the curved switch-rail main-ends of the at least two curved switch-rails (mSWR1, mSWR2) are diametrically opposed from the axis of rotation (Ax); and in that
- the switch-rail main-ends (mSWR0, mSWR1, mSWR2, etc.) are configured within a same plane and at a same perpendicular distance from the axis of rotation (Ax).

2. The rail-switching unit of claim 1,

wherein the main fixed-rail (MFR) and the switch-rails (SWR0, SWR1, SWR2, etc.) are shaped and/or configured to allow engagement between the internal end of the main fixed-rail (iMFR) and any of the main ends of the switch-rails (mSWR0, mSWR1, mSWR2, etc.) by means of mating profiles at main ends called main mating profiles (MMP0, MMP1, MMP2, etc.);

and/or wherein the branch fixed-rails and the switch-rails are shaped and/or configured to allow engagement between the internal ends of the branch fixed-rails (iBFR0, iBFR1, iBFR2, etc.) and the corresponding branch ends of switch-rails (bSWR0, bSWR1, bSWR2, etc. respectively) by means of mating profiles at branch ends called branch mating profiles (BMP1, BMP2, BMP3, etc.);

wherein a main mating profile (MMP0, MMP1, MMP2, etc.) comprises:

- a main mating surface called female (fMMS) that is present on the internal end of the main fixed-rail (iMFR),
- and a main mating surface called male (mMMS0, mMMS1, mMMS2, etc.) that matches the female surface (fMMS) and that can be present on any of the main ends of the switch-rails (mSWR0, mSWR1, mSWR2, etc.~~)~~ respectively);

wherein a branch mating profile (BMP0, BMP1, BMP2, etc.) comprises

- a branch mating surface called female (fBMS0, fBMS1, fBMS2, etc.), present on any of the internal ends of the branch fixed-rails (iBFR0, iBFR1, iBFR2, etc.);
- and a branch mating surface called male (mBMS) that matches a corresponding female surface (fBMS0, fBMS1, fBMS2, etc.), and that can be present on any of the branch ends of the switch-rails (fSWR0, fSWR1, fSWR2, etc.~~)~~ respectively);

wherein a branch or main mating surface that is called female (fMMS or fBMS) does not necessarily have to be mainly concave and a branch or main mating surface that is called male (mMMS or mBMS) does not necessarily have to be mainly convex;

and wherein the mating profiles are configured to allow firm connection between switch-rails and fixed-rails and are configured to facilitate smooth movement of the switch-rails into and out of their positions of engagement with corresponding fixed-rails.

3. The rail-switching unit of claim 2,

wherein at least one of the mating profiles is designed and configured to facilitate halting the continuity of the rotational movement of the rotatable ensemble when a certain active position of a switch-rail has been reached, to facilitate maintaining the reached active position of the switch-rail, and to facilitate the reversal of the direction of the rotational movement of the rotatable ensemble in order to come out of the reached active position of the switch-rail;

and/or wherein at least one of the mating profiles is configured to facilitate smooth and controlled movement of the switch-rails into and out of their active positions of engagement with the corresponding branch fixed-rails preferably by means of specific shapes of the male and female mating surfaces and/or by means of using one or more sets of mating profile bearings (MPB1, MPB2, MPB3, etc.), these preferably being sets of bearings and/or other auxiliary mechanisms to reduce friction and/or control relative movement between surfaces which are integrated with one or both of the mating surfaces.

4. The rail-switching unit of any of the previous claims,

wherein the set of switch-rails consists of

- a switch-rail with a basically straight shape and called straight switch-rail (SWR0),
- a first switch-rail with a basically curved shape and called first curved switch-rail (SWR1),
- and a second switch-rail with a basically curved shape and called second curved switch-rail (SWR2);

wherein the set of branch fixed-rails consists of

- a fixed-rail shaped and/or configured to be connected with the straight switch-rail and called straight-path branch fixed-rail (BFR0),
- a fixed-rail shaped and/or configured to be connected with the first curved switch-rail and called first curved-path branch fixed-rail (BFR1),
- and a fixed-rail shaped and/or configured to be connected with the second curved switch-rail and called second curved-path branch fixed-rail (BFR2);

wherein when the straight switch-rail is rotated into active position, it engages simultaneously on a main end with the main fixed-rail and on a branch end with a corresponding straight-path branch fixed-rail;

wherein when the first curved switch-rail is rotated into active position, it engages simultaneously on a main end with the main fixed-rail and on a branch end with a corresponding first curved-path branch fixed-rail;

wherein when the second curved switch-rail is rotated into active position, it engages simultaneously on a main end with the main fixed-rail and on a branch end with a corresponding second curved-path branch fixed-rail;

wherein all engagements between switch-rails and corresponding fixed-rails provide a continuous running surface and/or a continuous connection between the switch-rail and the corresponding fixed-rail in a bi-directional way, that is in one direction, in the other direction, or in both directions~~;~~.

5. The rail-switching unit of any of the previous claims,

wherein the first curved switch-rail and the second curved switch-rail have different curvature profiles.

6. The rail-switching unit of any of the previous claims,

further comprising

- an actuator arrangement to provide and transmit the necessary drive for the rotational movement of the rotatable ensemble;

wherein the actuator arrangement may be able to actuate on only one rotatable ensemble or simultaneously on two or more rotatable ensembles of different rail-switching units.

7. The rail-switching unit of any of the previous claims,

further comprising

- a mechanism to block angular positions of the rotatable ensemble, named position-blocking mechanism (PBM), to assure and/or reaffirm precision and solidness of the engagement between switch-rails and fixed-rails by allowing firm, fast and timely blocking and unblocking of the rotatable ensemble by means of a multi-point latch mechanism operated by a control system and/or mechanically linked with the angular movement of the rotatable hub;

wherein the position-blocking mechanism (PBM) may be able to operate on only one rotatable ensemble or on two or more rotatable ensembles of different rail-switching units.

8. The rail-switching unit of any of the previous claims,

further comprising

- an engagement-guiding system (EGS) with the purpose of providing controlled rotational movement of the rotatable hub and the switch-rails during transitional phases, and/or of accurately guiding the ends of the switch-rails into precise and/or smooth engagement with their corresponding ends of the fixed-rails.

9. The rail-switching unit of claim 8,

wherein the engagement-guiding system comprises:

- a set of one or more stationary engagement guides (SEG1, SEG2, etc.),
- a set of one or more engagement-guiding bearings (EGB1, EGB2, etc.),
- and a set of one or more rotatable engagement components (REC1, REC2, etc.);

wherein the engagement-guiding bearings, which are preferably cylindrical roller bearings or needle roller bearings and/or any other auxiliary mechanisms to reduce friction and/or control relative movement between surfaces, are configured to facilitate the interaction between stationary surfaces of the stationary engagement guides and moving surfaces of the rotatable engagement components to accurately control their relative motion and/or to reduce the potential friction and constraint between them, with the ultimate objective of achieving a fast, smooth and precise engagement between switch-rails and corresponding fixed-rails;

and wherein the rotatable engagement components provide surfaces to interact with the stationary engagement guides directly or by means of engagement-guiding bearings, are fixed to the rotatable ensemble, integrate with the rotatable hub and/or the switch-rails and/or the auxiliary components, and may integrate with mating profile surfaces at the ends of the switch-rails.

10. The rail-switching unit of claim 9,

wherein the set of stationary engagement guides comprises:

- one or more stationary engagement guides placed in outermost rings and presenting guiding surfaces with inward curving called concave guiding surfaces (CNC),
- and/or one or more stationary engagement guides placed in innermost rings and presenting guiding surfaces with outward curving called convex guiding surfaces (CNV);

wherein the concave or convex guiding surfaces do not necessarily have to be continuous, and if so, they have the general shape of an arch covering up to approximately 180 degrees;

wherein the concave or convex guiding surfaces are fundamentally concentric and share the same axis of rotation of the rotatable hub;

and wherein the concave or convex guiding surfaces that are adjacent to an internal end of a branch fixed-rail are fixed to it and configured to allow smooth and precise engagement of the end of the switch-rail and its mating profile if present with the corresponding end of the fixed-rail and its mating profile if present.

11. The rail-switching unit of claim 10,

wherein, with the purpose of minimizing slacks, facilitating deceleration of the rotational movement of the rotational ensemble, and thus improving the final speed and accuracy of the connections between fixed-rails and switch-rails when reaching active positions,

at least one of the concave guiding surfaces (CNC) has a curvature profile with a curvature radius that is slightly and progressively reduced at one or both end sections of the stationary engagement guide (bCNC and bCNC') and/or at the mid-section of the stationary engagement guide (mCNC),

and/or at least one of the convex guiding surfaces (CNV) has a curvature profile with a curvature radius that is slightly and progressively increased at one or both end sections of the stationary engagement guide (bCNV and bCNV') and/or at the mid-section of the stationary engagement guide (mCNV).

12. The rail-switching unit of claims 10 or 11,

wherein at least one rotatable engagement component is shaped integrating the matching profiles of different branch ends of switch-rails and providing surfaces that

allow simultaneous interaction with a concave guiding surface and with a convex guiding surface.

13. Track-switching unit,

for use to allow controlled and selective switching of a segment of a track or guideway;

the track-switching unit comprising:

- one or more rail-switching units (RSU1, RSU2, etc..) of the previous claims,
- a set of components linked to or part of an electronic operating control system (OCS),
- a supporting structure (TSU-ST);

wherein the number of rail-switching units is equal to the number of rails that compose the track segment affected by the track-switching unit;

wherein the track-switching unit is configured so that the internal ends of the branch fixed-rails (iBFR0, iBFR1, iBFR2, etc.) of the rail-switching units (RSU1, RSU2, RSU3, etc.) do not necessarily have to form a plane and, if so, the plane they form is not necessarily of horizontal nature;

wherein when comprising more than one rail-switching unit and in their normal operating mode, the rail-switching units are meant to be operated in a simultaneous way, but not necessarily by means of mechanical links between them, and not necessarily in a precise synchronous manner;

wherein when comprising more than one rail-switching unit and in their normal operating mode, the rail-switching units are meant to be operated congruently so as to create viable paths of continuity for the vehicles to move along the track;

and wherein the supporting structure (TSU-ST) supports, consolidates and protects elements comprised within the track-switching unit (TSU) and, if appropriate, also firmly attaches them to the ground and/or to the common guideway structures or integrates them with the supporting structures of the rail-switching units.

14. The track-switching unit of claim 13,

wherein the guideway rails (CR) are supported from the outside of the track, and/or the sets of wheels (tW, sW, bW) of the wheels-assemblies (WA) are wrapped around the rails (CR) from the inside of the track; and/or

wherein the width of the track (HGAP) and/or the maximal width of the vehicle body without considering the wheels-assemblies or vehicle body width (wVB), are adapted so that the vehicle, when directed through a track-switching unit (TSU1/2/3/..), is able to fit within the horizontal gap between two rails of a same track (HGAP) and pass through the track-switching unit without any inadequate interferences; and/or

wherein clearance gaps above and below the rails (tvGAP and bvGAP) are minimized fundamentally at the internal ends of the branch fixed-rails; and/or
the top height of the wheels-assembly (thWA) is minimized to the height of its top wheels (tW); and/or the bottom height of the wheels-assembly (bhWA) is minimized to the height of its bottom wheels (bW), whilst always allowing the wheels-assemblies (WA) to pass through the track-switching unit without any inadequate interferences; and/or

wherein the tracks in diverging/merging points are progressively vertically distanced /approximated avoiding any lateral turns of the tracks in a portion of the guideway called straight-guideways segment (SGS) that is linked to the branch fixed-rails and thus is adjacent to the track-switching unit (TSU1/2/3/..); and/or

wherein the longitudinal length of straight-guideways segments (lSGS) is reduced by means of minimizing the top height of the vehicle body (thVB) and/or minimizing the bottom height of the vehicle body (bhVB); and/or

wherein the segments of guideway adjacent to the track-switching unit (TSU) and/or the general common guideway and/or vehicles running through the track-switching unit (TSU) are adapted as a consequence of directly or indirectly applying some or all of the above limitations.

15. Track-switching system (TSS)

for use to allow coordinated and controlled selective switching of multiple track segments of a vehicle-guiding system (VGS),

comprising:

- one or more track-switching units (TSU1, TSU2, TSU3, etc..) of claims 13 or 14,
- an electronic operating control system (OCS),
- and a supporting structure (TSS-ST);

wherein the electronic operating control system manages the one or more track-switching units, including activating, coupling, verifying, maintaining and controlling the functioning of the track-switching units and their rail-switching units;

and wherein the supporting structure (TSS-ST) supports, consolidates and protects elements comprised within the track-switching system (TSS) and, if appropriate, also firmly attaches them to the ground and/or to the common guideway structures or integrates them with the supporting structures of the track-switching units.