Electric drive vehicle and the procedure of use

The subject of the invention is an electric drive vehicle, and the procedure of use, which is fitted with load bearing tyres, battery, and a self-driving vehicle control system, and which is capable of taking current from below, of running on a fixed track in a derail-safe manner, and of connecting to a rail while moving.

There are numerous known electric drive vehicles, including trams, trains, and automobiles. Several cities operate trams that take current from below and run on a fixed track. The APS (Alimentation par le Sol) system developed by Alstom is aesthetic, but it is expensive and is not secured against derailment. Such downtown tram networks – operated without overhead wires – have been implemented, among others, in the following cities: Dubai, Bordeaux, Angers, and Reims. The GLT (Guided Light Transit) vehicles by Bombardier and the vehicles by Translohr are modern public transport vehicles running on fixed tracks and are similar to the above-mentioned ALSTOM Citadis trams. These vehicles have tyres and run on a guiding rail located between the wheels. However, unlike the invention, they do not take the power from below but from overhead wires networks. The solution implemented by Translohr is somewhat closer to the invention, as those vehicles are fitted with mechanic protection against derailment.

The solutions described in US patent documents Nos. US4090452A and US4969400A are connected to a rail below a below-powered vehicle, in the middle, and are protected against derailment. The setback of the inventions is that they can run on rails, on a fixed track only. They do not have any battery and cannot move unless powered by an external source. This is a significant disadvantage as usually enormous action is needed to install rails on every road section. The rail-based system described in the documents is rather complex and complicated because, among others, the road needs to be elevated under the wheels. Due to the complexity of the above-mentioned transport systems, the implementation of these solutions would be rather expensive.

The European patent document No. EP1726503A2 is rather similar to the above-mentioned documents; it describes a train-like electric driven vehicle, which is capable of taking electric power through various means. In an implementation form, it can take power from below, while, in another implementation form, it can run on battery. The invention operates in a rail-based system and is fitted with guiding wheels against derailment. The vehicle is also fitted with tyres filled with compressed air, which are protected against flattening through the use of smaller hollows. However, this invention also has numerous disadvantages – for example, it cannot run on an unfixed path.

UK publication document No. GB946570A and US publication document No. US3001484A describe vehicles that are fitted with tyres and run on rails. They have numerous lower wheels that protect the device against derailment.

Japanese patent document No. JP2007203910A describes a vehicle that runs on a guiding rail and is fitted with tyres. Guiding wheels – which are in magnetic connection with the rail – are mounted onto the bottom of the vehicle to provide protection against derailment.

US publication document No. US3461811A describes a vehicle which is similar to those described above, is protected against derailment, and runs on a rail.

US patent descriptions Nos. US2006286830A1 and US2013020164A1 describe inventions powered from below and running on rails.

US publication document No. US4129203A describes an invention that is an electric vehicle running on roads, which is powered by a device installed within the pavement.

Spanish patent document No. ES2021538A6 also describes an electric vehicle that takes power from below, has tyres, and also has a battery. The vehicle can also be powered from overhead wires, if necessary.

British publication document No. GB1403646A describes an electric vehicle that takes power from below and can run on both rails and ordinary roads.

Similarly to the above documents, Japanese publication document No. JPS62181929A describes a vehicle that is powered from below, where the power supply cable is located in a gap between the rails.

US publication document No. US461057A describes a vehicle that is powered from below and runs on rails.

US patent documents Nos. US3914562A and US3637956A describe electric automobiles that are fitted with batteries, run on roads, and are powered from below.

German patent document No. DE3719708A1 describes a conductor device that can be mounted on regular automobiles running on tyres on roads, enabling them to run on rails as well. The device is protected against derailment.

The purpose of the invention is to eliminate the shortfalls of known solutions and to design a device and a procedure of use that have far more advantages than the currently known electric vehicles and offer a significantly cheaper solution to customers. This solution extends the capabilities of known electric vehicles. Known electric vehicles have numerous shortfalls, all of which are related to the operation of the battery. Batteries have short duration, are very expensive, very large, heavy, slow to charge, and allow vehicles to make short trips only. This is why the battery mode needs to be developed and enhanced through another environmentally friendly solution. The invention enables batteries to be charged while travelling. Operation is enhanced by the rail-system. High-voltage – i.e. power supply and vehicle guiding – rails are installed at certain road sections. The rails provide power from below, which is a far more affordable and aesthetically pleasing setup than the overhead wire network currently in use. This solution makes the system cheaper as the batteries do not need to be operated while running on these rail sections, and the rails need to be installed only once to be in place for use by all vehicles. The vehicles do not place unnecessary burden onto the rail, the rail will not be worn and torn by the heavy load, as the vehicles are designed to carry most of their weight on their own tyres. This is what they are called load bearing tyres. Its structure enables the vehicle to draw power both from its battery and an external source. It is an important objective that the vehicle can run both on free tracks – such as normal streets – and fixed tracks – rails. However, in the case of known inventions capable of achieving this objective, the vehicle must stop – i.e. reduce its speed to zero – before switching into rail mode. In this case, the vehicle can switch to rail mode while running. The camera installed in the front of the vehicle provides a video feed that is read by the image recognition system. This relays the information on what to do to connect to the rails. Due to the self-driving vehicle control system, the vehicle adjusts its position by itself automatically and drives toward the rails perfectly. A discrepancy of a few centimetres can also be handled by the side-guiding metal wheels. Another objective is that the vehicles running on the rail do not block other vehicles running behind. This might happen, for example, if case of a flat tyre. In case of such an accident, the vehicles approaching from behind would be unable to pass by the vehicle with the flat tyre. This is why the invention is fitted with non-flattening tyres, to avoid such incidents. It is a fundamental objective that the electric vehicle does not emit any harmful material and is operated in an environmentally safe manner. Another objective is to avoid derailment related accidents that are common with vehicles running on rails. For this reason, the vehicle is fitted with side-guiding wheels, the rims of which hold the guiding rail in the middle tightly. Should the vehicle be tilted or elevated in any way, the metal wheels on the side would jam into the rail thereby preventing the vehicle from derailment. The vehicle helps to avoid traffic accidents even while running on a free track, since the image recognition system is capable of recognizing even unlit pedestrians and animals on the street. In such cases, the self-driving vehicle control system can make important decisions, such as activating the emergency breaks.

The inventive step is based on the recognition that a vehicle that is environment-friendly and significantly cheaper than any known electric drive vehicle can be created, if the characteristics of electric vehicles and the advantages of vehicles running on single rails are exploited and other, unknown or less common technical solutions are also used. If the battery powered free track mode used on roads is aided by below-powered sections, the expensive battery use may be minimised. This way, we can create a vehicle that can move on both free and fixed tracks and can take power both from a battery and external sources. The invention also has numerous features that make this solution a worldwide novelty and a gap-filling item. The use of a below trolley arm of the invention – which is less common in above-ground traffic – is aesthetically more pleasing than using an overhead wire network. The solution is protected against derailment, which means that it is fitted with mechanical protection against any derailment or jumping from the rail. Unlike other vehicles running on rails, the vehicle is also fitted with flexible tyres, which also bear load, meaning that the weight of the vehicle is borne by the tyres. These tyres are non-flattening tyres, so these kinds of accidents are also eliminated when using the invention. It also forms part of the inventive step that the risk of an accident of any kind may be significantly reduced and a vehicle that is far better and safer than other known vehicles may be designed if vehicle is fitted with non-flattening tyres, a rail connector unit that is protected against derailment, a self-driving vehicle control system, an optical mapping unit, an image recognition system, and a radar. It is another solution, which has been unknown so far, that the switch between free track mode and fixed track mode may be made without any significant reduction in speed.

According to the set objective, the most general implementation form of the device according to the invention is described in claim 1. The most general form of the procedure of use is described in claim 8. The various forms of implementation are described in the other claims.

The invention is presented in more detail by the forms of implementation and on the basis of drawings.

On the attached drawings,

Figure 1 shows the side-view of the electric drive vehicle running on a free track

Figure 2 shows the side-view of the electric drive vehicle running on a fixed track connected to the rail,

Figure 3 shows an axonometric view of the rail connector unit of the vehicle,

Figure 4 shows the rail connector unit seen from above,

Figure 5A shows the longitudinal section of the protective pipe

Figure 5B shows the cross section of the protective pipe and the guiding unit,

Figure 5C shows the cross section of the protective pipe and the middle wheel,

Figure 6A shows the front view of the vehicle and presents the process of connecting to the rail while moving, when the vehicle is too far to the left to connect to the rail,

Figure 6B shows the front view of the vehicle and presents the process of connecting to the rail while moving, when the vehicle is too far to the right to connect to the rail,

Figure 6C shows the front view of the vehicle and presents the process of connecting to the rail while moving, when the vehicle is in the right position to connect to the rail,

Figure 6D shows the front view of the vehicle and presents the process of connecting to the rail while moving, when the vehicle is in the right position to connect to the rail and the rail connecting unit lowered,

Figure 7 shows the side-view of the rail connecting unit in a closed position,

Figure 8 shows the front view of the rail connecting unit in a closed position,

Figure 9 shows the front view of the rail connecting unit when the middle wheel hits the rail,

Figure 10 shows the front view of the connected rail connecting unit,
Figure 11 shows the side-view of the connected rail connecting unit,
Figure 12 shows the front view of the electric drive vehicle when connected to the rail.

Figure 1 shows the side-view of the electric drive vehicle 1 running on a free track. In this case, the electric drive vehicle 1 is not connected to the rail, and the trolley arm 2 and the rail connector unit 3 is in a closed, inactive position. The trolley arm 2 is pulled into the correct position by the breaker 5. The weight of the electric drive vehicle 1 is carried by the load bearing tyres 8, which also provide guidance on the side. An optical mapping unit 6 is installed at the front of the electric drive vehicle 1, which is connected to the image recognition system 7. In free track mode, the electric drive vehicle 1 is powered by a battery.

Figure 2 shows the setup of the electric drive vehicle 1 in fixed track mode. The weight of the electric drive vehicle 1 is still carried by the load bearing tyres 8, but guidance is provided by the guiding rail 4. The guiding rail 4 has zero electric potential. In fixed track mode, the breaker 5 lowers the trolley arm 2 that is capable of taking electric power. In fixed track mode, the rail connector unit 3 is also in a lowered position. The rail connector unit 3 provides connection to the guiding rail 4. The optical mapping unit 6 is installed at the front of the electric drive vehicle 1, which is connected to the image recognition system 7. The image recognition system 7 detects the distance to the guiding rail 4, and the self-driving vehicle control system drives the vehicle accordingly to enable the electric drive vehicle 1 to connect to the guiding rail 4. In fixed track mode, the electric drive vehicle 1 is powered from an external source.

Figure 3 shows the components of the rail connector unit 3, as the entirety of the components and the harmonized design thereof ensures connection to the guiding rail 4, so that this connection is protected against derailment. The guiding rail 4 has zero electric potential. The rail connector unit 3 is held by suspended levers 9. The levers 9 are connected to the connection point by pins 10, which are located on the chassis of the electric drive vehicle 1. The levers 9 are always parallel with each other. The rail connector unit 3 is lowered and pulled up by the lifter 12. The lifter 12 is connected to the mount 11 and is rotated with the help of the pins 10. The piston rods 13 of the lifter 12 are also connected to the mount 11. In this structure, the protective pipe 14 containing the electric motor is also an important component, which is also connected to the mount 11. Power is supplied to the protective pipe 14 through the cable 18. The protective pipe 14 is connected to guiding units 15, which can move relative to the pipe. The main task of the electric motor – composed of stationary and rotating components – located in the protective pipe 14 is, in fact, to move sideways, close, press, or release, move away, and open the metal side-guiding wheels 16 by moving the guiding units 15. Thus, the guiding units 15 are also connected to the side-guiding wheels 16. These side-guiding wheels 16 are made of steel or other solid metal, they do not become deformed, and their axis is close to vertical. The side-guiding wheels 16 are also in touch with the guiding rail 4 and they rotate around their respective centres of motion while the electric drive vehicle 1 is moving. They have rims 17 which touch the guiding rail 4 from below. By doing so, they provide mechanic protection against derailment, as the rims 17 jam into the rail whenever the electric drive vehicle 1 would be elevated. The other components of the device include the middle wheel 19, which – structurally – is connected to the protective pipe 14. The middle wheel 19 does not carry any weight of the vehicle but provides assistance mostly to set the height, as the side-guiding wheels 16 are moved and held by the electric motor, as soon as it (the middle wheel 19) touches the guiding rail 4.

Figure 4 shows the components of the rail connector unit 3 as seen from above. It can be seen that the lifters 12 are connected to the mounts 11 and that the middle wheel 19 is located between the mounts 11. The connected protective pipe 14 is in a perpendicular position and leads the cable 18 providing power for the electric motor. The side-guiding wheels 16 are connected to the guiding rail 4 and have rims 17 that jam into the guiding rail 4 thereby protecting the vehicle against derailment. The levers 9 are parallel with each other and suspend the entire structure. They are connected to the chassis of the vehicle and to the mounts 11.

Figure 5A shows the structural components located in the protective pipe 14. The axis of the middle wheel 19 – which does not bear any load – and of the protective pipe 14 is the same. The protective pipe 14 is connected to the mount 11, which is perpendicular to this axis. The protective pipe 14 is also in touch with the guiding units 15, which can move relative to the pipe. The electric motor has a stator 20, a rotor 21, a stator end-winding 22, and a shaft 23.

The threads 24 are located on the two ends of the shaft 23. The units also include the bearings 25 that rotate and support the middle wheel 19.

Figure 5B shows a section of the protective pipe 14, the shaft 23 with the threads 24 is shown in a section, as well as the connecting guiding unit 15, which can turn relative to the protective pipe 14.

Figure 5C shows a section of the protective pipe 14 as well. The shaft 23 of the electric motor, the stator 20 and the rotor 21 are visible. These are located in the protective pipe 14. The bearings 25 that rotate and support the middle wheel 19 are located on the outside of the pipe.

Figure 6A shows the electric drive vehicle 1 as it connects to the guiding rail 4 while moving. In the step shown on the drawing, the electric drive vehicle 1 is too far to the left of the high-voltage rail 27 and the guiding rail 4. In the course of interpreting the image 26 produced by the optical mapping unit 6, the image recognition system 7 recognises the situation and the self-driving vehicle control system drives the electric drive vehicle 1 to the right until the guiding rail 4 is located in the middle of the electric drive vehicle 1, so that the appropriate parts and wheels could lock on the guiding rail 4. Most of the weight of the electric drive vehicle 1 is carried by the load bearing tyres 8 both in free and fixed track mode.

Figure 6B shows a front-view image of the electric drive vehicle 1 switching to fixed track mode while moving. In the step shown on the drawing, the electric drive vehicle 1 is on the right of the high-voltage rail 27 and the guiding rail 4, so connection is not possible. The optical mapping unit 6 records the image 26, and then the image recognition system 7 detects the problem and transmits the task of driving electric drive vehicle 1 to move to the left. The task is carried out and the vehicle is driven to the left by the self-driving vehicle control system into the ideal position for connecting. Before connecting to the guiding rail 4, the wheels with load bearing tyres 8 provide side guidance in free track mode.

Figure 6C shows the front view of the electric drive vehicle 1 switching to fixed track mode while moving, before connecting to the guiding rail 4. The image 26 recorded by the optical mapping unit 6 is interpreted by the image recognition system 7. In the step shown on the drawing, the position of the electric drive vehicle 1 is approved, as the electric drive vehicle 1 is in a good position to connect to the guiding rail 4 and to switch from the battery powered mode to the use of the power provided by the guiding rail 4 and the high-voltage rail 27 and to the fixed track mode. Thus, no further manoeuvres are needed. In fixed track mode, the electric drive vehicle 1 is guided by the guiding rail 4, instead of the load bearing tyres 8. The weight of the electric drive vehicle 1 is still carried by the load bearing tyres 8. The load bearing tyres 8 are non-flattening; this is necessary to ensure that the vehicles following each other on the guiding rail 4 would not be forced to stop by a flat tyre of a vehicle, as they could not leave the rail without waiting for the repair or replacement of the flat tyre of the vehicle.

Figure 6D shows the front view of the stage where the electric drive vehicle 1 connects to the guiding rail 4. The middle wheel 19 and the entire rail connector device is lowered and the fixed track mode is commenced. The optical mapping unit 6 and the image recognition system 7 is shown in the front of the vehicle. The electric drive vehicle 1 has four non-flattening and flexible load bearing tyres 8, which, in fixed track mode, only carry weight but do not provide any guidance. The high-voltage rail 27 is shown on the left side of the guiding rail 4 of zero potential. The electric drive vehicle 1 is powered by these rails 4, 27 during fixed track mode, instead of the battery. The lower control arms of the wheel suspension 28 are also shown on the front view figure.

Figure 7 shows the device from the side when it has yet to connect to the guiding rail 4. The figure shows one of the side-guiding wheel 16 that would later catch on the guiding rail 4 and protect against derailment. Structurally, the side-guiding wheel 16 meets the guiding unit 15. The axis of the side-guiding wheel 16 is approximately vertical, while the axis of the middle wheel 19 is horizontal. The figure shows a side view of the protective pipe 14 housing the electric motor, which is provided with power through the cable 18. The piston rod 13 and the levers 9 suspending the entire rail connecting unit are connected to the mount 11. The levers 9 can turn on the pins 10 and are connecting to the connection points through the pins 10.

Figure 8 shows the front view of the components connecting to the rail. The middle wheel 19 is not completely aligned with the guiding rail 4, but the side-guiding wheels 16 can open wide enough this small difference not to cause any problem, so that the side-guiding wheels 16 could connect to the guiding rail 4. In the step shown on the drawing, the side-guiding wheels 16 are moving downward toward the guiding rail 4 with the entire rail connecting unit.

The protective pipe 14 housing the horizontal electric motor is also shown, and the mounts 11 are perpendicular to the axis thereof. The electric motor located in the protective pipe 14 is powered through the cable 18. The piston rods 13 are connected to the mount 11. The side-guiding wheels 16 are connected to the protective pipe 14 by the guiding units 15.

On Figure 9, the side-guiding wheels 16 have reached and have been lowered to the height of the guiding rail 4. At this point, the side-guiding wheels 16 connected to the guiding rail 4 between them by approaching each other. The front view drawing also shows the side-guiding wheels 16 connecting to the protective pipe 14 through the guiding unit 15. The guiding rail 4 is touched by the middle wheel 19 from above, which is made of hard metal and its axis is horizontal. This plays an important role in setting the height. The electric motor located in the protective pipe 14 is powered through the cable 18. The piston rods 13 are connected to the mounts 11 and are directed upward, and the protective pipe 14 is perpendicular to the mounts 11.

Figure 10 shows a front view of the vehicle at the moment of already being connected to the fixed track. The slightly tilted side-guiding wheels 16 are locked on the guiding rail 4, and the vehicle starts to move on the rail as the middle wheel 19 and the side-guiding wheels 16 rotate. The rim 17 of the side-guiding wheels 16 catches on the guiding rail 4 to provide mechanic protection for the vehicle against derailment. The figure also shows the side-guiding wheels 16 connecting to the protective pipe 14 through the guiding unit 15. Power is supplied to the protective pipe 14 housing the electric motor through the cable 18. In such cases, the power required to operate on the fixed track is acquired from external sources. The piston rods 13 and the protective pipe 14 are connected to the mounts 11.

Figure 11 shows the side-view of the device already connected to the guiding rail 4. The side-guiding wheels 16 are at the same height as the guiding rail 4 and provide strong connection by catching on to it. The side-guiding wheels 16 are connected to the protective pipe 14 through the guiding unit 15. The middle wheel 19, the axis of which is horizontal, touches the top of the guiding rail 4. The levers 9 suspending the device are parallel with each other and are connected to the connecting devices – e.g. to the mount 11 in one direction – through the pins 10 at their ends. They can also rotate around the pins 10. The piston rod 13 starts from the mount 11. The cable 18 supplying power is connected to the protective pipe 14.

Figure 12 shows the front view of the electric drive vehicle 1 when it is connected to the guiding rail 4. The optical mapping unit 6 and the image recognition system 7 is shown in the front of the vehicle. The electric drive vehicle 1 has four non-flattening and flexible load bearing tyres 8, which, in fixed track mode, only carry weight but are not involved in providing guidance. In such cases, guidance is provided by the guiding rail 4 mostly. The rail connector unit 3 is in connection with the guiding rail 4 and it has numerous important components, as shown on previous figures. The rail connector unit 3 can be lowered or elevated by the lifter 12. When running in fixed track mode as shown on the drawing, the electric drive vehicle 1 supplied with power from external source, i.e. power is collected from the high-voltage rail 27 and the guiding rail 4 of zero potential using the trolley arm 2. The figure also shows the lower control arms of the wheel suspension 28.

In the course of using the invention, the electric drive vehicle 1 – according to the desired outcome – is powered by a battery or the combination of the guiding rail 4 and the high-voltage rail 27 and it runs on a free or fixed track. The entire weight of the electric drive vehicle 1 is carried by non-flattening load bearing tyres 8. The switch from free track mode to fixed track mode can be made at any time and any number of occasions without any significant change to speed. The switch is supported by the self-driving vehicle control system, the optical mapping unit 6, and the image recognition system 7, which drive the electric drive vehicle 1 above the guiding rail 4 automatically. Subsequently, the rail connector unit 3 is lowered by the lifters 12 to the height of the guiding rail 4, and the side-guiding wheels 16 are locked to the side of the guiding rail 4 using the guiding units 15, and the trolley arm 2 is touched to the high-voltage rail 27 using the breaker 5. In fixed track mode, the battery is charged from the external power source. When running in fixed track mode, the electric drive vehicle 1 is powered by the guiding rail 4 and the high-voltage rail 27. In order to avoid accidents while running in fixed track mode, the electric drive vehicle 1 is mechanically protected in fixed track mode by locking the side-guiding wheels 16 around the guiding rail 4 and catching the rims 17 of the side-guiding wheels 16 to the top of the guiding rail 4 from below. Thus, the side-guiding wheels 16 stop the electric drive vehicle 1 from being elevated in any way and thereby protect against movement and derailment. In free track mode, the rail connector unit 3 is pulled back and held by the lifter 12, the trolley arm 2 is pulled back and held by the breaker 5, and the electric drive vehicle 1 is powered by the battery.

The electric drive vehicle described above has numerous advantages. An advantage of the invention is that it provides a far more capable and cheaper solution to users than currently known electric vehicles. This solution expands the capabilities and overcomes the disadvantages of currently known electric vehicles. The most important advantage of the invention is that it enables electric vehicles to run on both battery and external power sources, on free and fixed track. Unfortunately, batteries have several shortfalls that set back the wide and popular use of electric automobiles. Their life expectancy is short, they are very expensive, large, heavy, slow to charge, and allow the vehicle to make short trips only. However, they can be more affordable if the expensive use of the battery is reduced by the application of another environment friendly solution. Furthermore, batteries can be charged while running, thereby avoiding the need to charge the vehicle at home for at least 8 to 10 hours. Unlike so far, the power supply for electric vehicles running on a fixed track do not need to be covered by an energy storage unit carried on board of the vehicle, as it can be covered from the local power network. This allows the electric automobile to travel technically unlimited distances. This is support by the realization of the rail system. High-voltage rails that provide power and guidance for the vehicles are installed at certain road sections. The rails allow for taking power from below, which is more affordable and aesthetically pleasing than the overhead wire system. It is also safer for birds. The vehicle takes the power from below using one or more trolley arms. It is practical to use the middle guiding rail for powering purposes, as this rail can provide the zero potential and can conduct power. At least two parallel lines with different electric potential are needed for conducting electricity, as they can create an electric circuit. It can be stated that this transport system is environment friendly, affordable, and aesthetically pleasing at the same time. These advantages cannot be met by any other means of transport. The rails need to be installed only once. The installation of a rail section is not even as expensive as the building of an overhead wire network. Another advantage is that the vehicles do not load any unnecessary burden onto the rails, and the rails would not be worn and torn by such load, as the design of the vehicles allows them to carry most of their own weight on flexible load bearing tyres. This is one of the features that separates the invention from railroad vehicles. The rail wheels – made of a rigid material – and the rail carry the weight of the rail connecting device only, which is only a small fragment of the total weight of the vehicle. The flexibility provided by the fact that the vehicle can be powered by both a battery and an external source is an enormous advantage. As a consequence, the vehicle can run on both free tracks – i.e. traditional roads – and fixed rail tracks as described above. However, known inventions having the same advantage required the vehicle to make a complete stop by reducing its speed to zero before connecting to the rail. In this case, tracks may be changed even while the vehicle is moving. The vehicle is also fitted with radar, which may be ultrasonic radar or electromagnetic wave radar that operates by emitting and collecting electromagnetic waves. The optical mapping device located in the front of the vehicle – which may be a night-vision camera, an infrared camera, or a laser mapping device – records the image feed continuously and, after collection, the feed is interpreted by the image recognition system. It provides the information on the directions to follow to connect to the rail. With the help of the self-driving vehicle control system, the vehicle adjusts its position and drives itself toward the rail perfectly. The self-driving vehicle control system is a control and regulatory system that is capable of regulating the speed, acceleration, and position of one or more vehicles in one or more direction without human intervention. Vehicles fitted with such a system do not need active contribution by the driver to connect to the rail, allowing for faster, more precise, and more comfortable vehicle control with the exclusion of human factors (such as exhaustion, loss of concentration), but this requires appropriate sensors. Self-driving vehicles are capable to quickly react to traffic situations that are unexpected for human drivers in a pre-programed manner and are capable of making prompt decisions – e.g. to perform emergency breaking – correctly. This is supported by the image recognition system which is capable of detecting wandering animals and humans on the road in front of the vehicle and of making vehicle control related decisions on the basis of incoming information independently. It is an enormous advantage that the vehicles have non-flattening tyres. In case of an accident, the vehicles running on the rail would obstruct the vehicles running behind them, so the vehicles behind the vehicle with a flat tyre would be jammed and forced to wait until the tyre is replaced. These tyres cannot be pierced or cut by any sharp or pointed object in any way that would force the vehicle to stop or prevent the vehicle from moving on its originally planned track at the originally planned speed in normal mode. Typically, the air pressure in such tyres is not higher than the surrounding atmospheric pressure. It is an important advantage that the vehicles are protected against derailment. This can also prevent numerous unfortunate accidents. The vehicles have side-guiding wheels, the rims of which lock onto the middle guiding rail. If the vehicle is tilted or elevated, the two metal wheels on the sides jam into the rail and prevent the vehicle from derailment. Thus, the wheels cannot be distanced from the rail without being protected against derailment. Thus, the electric vehicle has numerous advantages that currently known electric vehicles do not have. It can run both on free and fixed tracks, can change between free track and fixed track mode while running, can be powered by a battery or a rail, collects power from below, is protected against derailment mechanically, does not emit any harmful material, has load bearing tyres, and is affordable. The vehicle is also fitted with a self-driving vehicle control system, an optical mapping unit, and an image recognition system. These tools provide significant assistance to the driver, contribute to transport safety, and facilitate the building of an automobile the capabilities of which are beyond our wildest dreams.

In addition to the above-mentioned examples, the invention can be implemented in other forms and with other production procedures within the scope of protection.

CLAIMS

1. Electric drive vehicle with lower trolley arm for traffic on free and fixed track, which includes a battery, **characterized in that** it has a rail connector unit (3) that is capable of connecting to a single guiding rail (4), at least two side-guiding wheels (16) are located in the rail connector unit (3) to prevent derailment, the side-guiding wheels (16) are connected to a guiding unit (15) that closes and opens them, the rail connector unit (3) is fitted with a lifter (12), and it has at least four non-flattening load bearing tyres (8), a mapping unit (6), and an image recognition system (7).

2. The vehicle according to claim 1, **characterized in that** the lower trolley arm (2) is connected to a breaker (5) capable of lowering and pulling it back.

3. Any of the vehicles according to claim 1 and 2, **characterized in that** the rail connector unit (3) includes a middle wheel (19), a protective pipe (14), and a mount (11), and the rail connector unit (3) is connected to the chassis of the electric drive vehicle (1) through levers (9).

4. Any of the vehicles according to claim 1 to 3, **characterized in that** a stator (20) and a rotor (21) constituting the electric motor is located in the protective pipe (14), and the electric motor controls the side-guiding wheels (16) through the guiding unit (15).

5. Any of the vehicles according to claim 1 to 4, **characterized in that** the optical mapping unit (6) and the image recognition system (7) is connected to the self-driving vehicle control system.

6. Any of the vehicles according to claim 1 to 5, **characterized in that**, in fixed track mode, the middle wheel (19) and the side-guiding wheels (16) touch the guiding rail (4), and the trolley arm (2) touches the high-voltage rail (27).

7. Any of the vehicles according to claim 1 to 5, **characterized in that**, in free track mode, the rail connector unit (3) and the trolley arm (2) is pulled back.

8. Procedure for using the electric drive vehicle according to claim 1, in the course of which the electric drive vehicle (1) is driven by an electric motor powered by a battery or the combination of the guiding rail (4) and the high-voltage rail (27) and runs on a free or fixed track, **characterized in that** the switch from free track mode to fixed track mode is made with keeping the approximate speed at least, while the entire weight of the electric drive vehicle (1) is carried by non-flattening load bearing tyres (8), and the electric drive vehicle is driven automatically above the guiding rail (4) with the support of the optical mapping system (6) and the image recognition system (7), and then the rail connector unit (3) is lowered by the lifters (12) to the height of the guiding rail (4), and the side-guiding wheels (16) are locked to the side of the guiding rail (4) using the guiding units (15), and the trolley arm (2) is touched to the high-voltage rail (27) using the breaker (5).

9. The procedure according to claim 8, **characterized in that**, in fixed track mode, the rail connector unit (3) is lowered by the lifters (12), the side-guiding wheels (16) are locked to the side of the guiding rail (4), and the trolley arm (2) is lowered by the breaker (5).

10. Any of the procedures according to claims 8 to 9, **characterized in that**, in fixed track mode, the electric drive vehicle (1) has mechanic protection, so that the side-guiding wheels (16) are locked around the guiding rail (4), and the rims (17) of the side-guiding wheels (16) are hooked into the top of the guiding rail (4) from below.

11. The procedure according to claim 8, **characterized in that**, in free track mode, the rail connector unit (3) is pulled back and held by the lifter (12), the trolley arm (2) is pulled back and held by the breaker (5), and the electric drive vehicle (1) is powered by the battery.

12. Any of the procedures according to claims 8 to 11, **characterized in that** the switch between free track mode and fixed track mode is made while running, maintaining the speed at least approximately.

13. Any of the procedures according to claims 8 to 12, **characterized in that** the electric drive vehicle (1) is fitted with a self-driving vehicle control system, which is connected to the optical mapping system (6) and the image recognition system (7).