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(54) LOADING SYSTEM AND TRANSPORTING WHEELED VEHICLES ON RAILWAY NETWORK

VERLADESYSTEM UND BERÄDERTE TRANSPORTFAHRZEUGE AUF EINEM SCHIENENNNetz
SYSTÈME DE CHARGEMENT ET TRANSPORT DE VÉHICULES À ROUES SUR RÉSEAU FERROVIAIRE

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Description

[0001] The present invention relates to a loading system and transporting wheeled vehicles on railway network.

[0002] In particular, in the present invention relates to a loading System and transporting wheeled vehicles on railway network, and in particular of articulated semi-trailer, of the type that can be integrated to an "intelligent management system" in the meaning that at the end was attributed with reference to the wagons of a rail transport system with automatic composition of the trains described in Italian patent No. 0001416154, assigned to the same Applicant.

[0003] As it is known, for the transport of railway wagons from factories to the delivery destination, or, conversely, by picking places in factories delivery free of tracks connected to the rail network, it is necessary to charge the wagon on a special vehicle equipped with wheel pulled by a tractor up to the rail delivery or pickup station of destination.

[0004] An attempt has been made to overcome the excessively high costs of this transfer method by loading semi-trailers of articulated lorries on locked-up trains in the railway stations, loading them from the top on "few" wagons, using a bridge crane. This solution is, however, competitive only on ports that handle a large number of semi-trailers, as the infrastructure has very high costs. Therefore, only a few stops can be connected, at acceptable costs.

[0005] Another known solution is the so-called "rolling highways", consisting in loading an entire train sequentially starting from a series of wheeled vehicles. This procedure, however, presupposes that the drivers of the vehicles also have to travel with the same train, in addition to the constraint that the connection is only between two points, the one of departure and the one of arrival.

[0006] It has been also tried to overcome this problem by designing autonomous mixed rail / wheeled vehicles that able to be moved with the two modes. However, these known vehicles are specific drives with very specific functions. So, these are not adapted to make long trips, or can be adapted to be used as systems for the transport of goods. Moreover, these known vehicles do not lend themselves to interact with "smart" systems or vehicles which exchange information, for example to be able to move independently on the rail network and / or to automatically engage or unhook thanks to the presence of computerized systems, such as those present in the "intelligent" wagons of the aforementioned patent of the same Applicant.

[0007] One solution to this problem has been reported in the Italian patent application No. UB2016A001791, which describes a transport vehicle capable of circulating ambivalently on the road network or on the railway network comprising: - a floor equipped at the bottom with a first system of rear railed wheels and a second system of front railed wheels and at least one pair of rear rubber

wheels ; - an exchange system between the position of the rear and front railed wheels and of the rear rubber wheels according to the type of wheels required for road or rail traffic; and - a computerized system configured to automatically manage the movements of the transport vehicle in the configuration of railway circulation and to carry out the coupling with the tractor of an articulated vehicle hooking up the means of transport; in which the exchange system comprises movable mechanical elements connected, at a first end, in a rotary manner, to hooking brackets placed below the floor and, at a second end, to axes around which the rear rubber wheels are respectively rotatable. The mobile mechanical elements are configured to be automatically controlled by the computerized system via an actuator system.

[0008] However this solution suffers from the problem that the presence on board of both the rail and road circulation systems, and of the other components of the smart wagon, like the batteries, overloads the vehicle particularly during the road circulation, reducing the net load. Furthermore, the passage from road to rail mode may present operational difficulties in correctly managing the alignment maneuver on the rails.

[0009] Another solution is described in the patent FR2828457 which reports a rail transport vehicle composed of variable level platforms (Pr) each end of which rests on railway wagons. Some variable level platforms receive in the low position large sized loads. Each variable level platform is rigid or comprises elements (Ea, Ec, Ee) articulated transversely making it rigid in the bottom position and rests on wagons (Wp). Each platform also comprises lateral support and wheel accessories (Ra) which are engaged on fixed accessory ramps (Ca) at the station entrance giving access to a raised support platform.

[0010] The problem of this solution is that the loading wagon is not intended for autonomous movement along the service binary and can't guarantee the safe loading of a semitrailer.

[0011] The scope of the present invention is to provide a system for loading and transporting on railway network wheeled vehicles comprising at least one articulated vehicle equipped with a drive and semitrailer, in particular semi-trailers, who can, with a very high level of automation, switch from wheeled mode to rail mode and vice-versa reducing the costs of the logistics of goods, since, while maintaining the ductility of the rubber of the sampling points and delivery operated by a conventional trucks, carries out, for the most part of the path, the transfer of only semitrailers with no drive along the railway line, with significant reduction in energy and personnel costs, having features such as to overcome the limitations that still affect the solutions previously described and with reference to the prior art.

[0012] According to the present invention, a system for loading and transporting on railway network wheeled vehicles comprising at least one articulated vehicle equipped with a drive and semitrailer is provided, as de-

fined in claim 1.

[0013] For a better understanding of the present invention, a preferred embodiment is now described for semi-trailers, purely by way of non-limiting example, with reference to the attached drawings, in which:

- the figure 1 shows a three-dimensional view of a system for loading and transporting on railway network wheeled vehicles comprising at least one articulated vehicle equipped with a drive and semitrailer in a phase of arrival of an articulated vehicle at the station, according to the invention;
- the figure 2 shows a three-dimensional view of a smart elevator wagon of the system for loading and transporting on railway network wheeled vehicles, according to the invention;
- Figures 3a-3c show respectively a top view and side views with a lowered loading platform and a raised loading platform of the smart elevator wagon of Figure 2, according to the invention;
- figures 4a- 4c show a top view and side views with the lowered loading platform and raised loading platform of the smart elevator wagon of figure 2 with an articulated truck loaded on the smart elevator wagon of figure 2, according to the invention;
- figures 5a-5d show respectively a top view, a side view and sectional views with a raised loading platform and with a lowered loading platform of a smart carrier wagon, according to the invention;
- Figures 6a-6c show a top view and side views of the smart elevator wagon of Figures 5a-5d with an articulated truck loaded above, according to the invention;
- figure 7 shows a top view of a railway station set up to interface with the system for loading and transporting on railway network wheeled vehicles, according to the invention;
- figure 8 shows a three-dimensional view of a smart elevator wagon of the system for loading and transporting on railway network wheeled vehicles and of the articulated vehicle when approaching the articulated vehicle to the elevator wagon, according to the invention;
- figure 9 shows a three - dimensional view of the elevator wagon of the system for loading and transporting on railway network wheeled vehicles with the articulated vehicle loaded , according to the invention;
- figure 10 shows a three-dimensional view of the elevator wagon in elevation phase and of the carrier wagon of Figure 9, with positioning of the carrier wagon, according to the invention;
- figure 11 shows a three-dimensional view of the elevator wagon and of the carrier wagon of Figure 9 in the loading phase of the articulated vehicle on the smart carrier wagon, according to the invention;
- figure 12 shows a three-dimensional view of the elevator wagon and of the smart carrier wagon during

the release of the tractor from the semitrailer on the smart carrier wagon, according to the invention;

- figure 13 shows a three-dimensional view of the elevator wagon on which the motor drive of the articulated vehicle and of the smart carrier wagon on which the semi- trailer of the articulated vehicle is loaded, according to the invention;
- figure 14 shows a three-dimensional view of the elevator wagon during the unloading of the tractor unit of the articulated vehicle and of the smart carrier wagon with the semi-trailer of the articulated vehicle being moved towards a railway train in the composition phase, according to the invention.

[0014] With reference to this and the figures and, in particular, to figure 1, a system for loading and transporting on railway network wheeled vehicles comprising at least one articulated vehicle equipped with a drive and semitrailer, in a phase of arrival of an articulated vehicle in the station is shown, according to the invention. More specifically, the system 100 for loading and transporting on railway network wheeled vehicles comprising at least one articulated vehicle 50 equipped with a drive and semitrailer comprises: a "station" computerized system, a smart elevator wagon 101 and a smart carrier wagon 102 interfaced with the station computerized system, in the meaning of terms used with reference to the wagons of a rail transport system with automatic train composition described in the Italian patent No. 0001416154 in the name of the same Applicant; and a carriageable road infrastructure 103 that allows connection of the road network to an area where a service binary of the railway network is located, this area being connected to the railway line of the same railway network and being dedicated to the loading / unloading of the semi-trailer, subject to the asphaltting of an adequate section of roads. The carriageable road infrastructure 103 must allow both access and the exit of the articulated vehicle 50 in the moving direction and in its opposite.

[0015] Figure 2 shows, in detail, the smart elevator wagon 101 comprising a platform 101a, configured to accommodate a wheeled vehicle, for example an articulated vehicle 50 equipped with a drive 51 and a semitrailer 52, equipped, at a first end , of a first tipping plane 101b hinged at the first end and, at a second end, opposite to the first, of a second tipping plane 101c hinged at the second end, laterally of external containment fenders 121 configured to achieve the perfect alignment of the articulated vehicle 50 and laterally to the containment fenders 121, a gangway 122 for the passage of an operator. The platform 101a is coupled at the bottom to a linear structure 101d equipped, for example in a central portion, with an electronic control system 123 and, at its ends, of carriages 101da with motorized rooms . Furthermore, the smart elevator wagon 101 includes scissor lifting structures 101e, at least two, fixed between the linear structure 101d and the platform 101a. Each lifting structure 101e is composed of two scissor systems (of the

pantograph type), allowing a movement in the vertical direction and supporting the platform 101a. Even more detailed, each scissor system is composed of four metal bars connected, two by two, by central pins and, at the ends, by upper and lower hinges.

[0016] According to an aspect of the invention, the lifting structures 101e are configured to lift and lower the platform 101a of the smart elevator wagon 101 through actuators, for example two lifting pistons for each lifting structure 101e, not shown in the figure.

[0017] According to an aspect of the invention, the electronic control system 123 is positioned between the two lifting structures 101e is positioned.

[0018] Advantageously according to the invention, the lifting of the platform 101a of the smart elevator wagon 101 can be controlled both by manual mode and by automatic mode.

[0019] Advantageously according to the invention, the smart elevator wagon 101 comprises a computerized system like that typical of smart wagons of the aforementioned Applicant's patent application, configured to be able to further automatically manage the raising / lowering of the platform 101a and the movement of the elevator wagon 101 along the railway infrastructure to position itself in the specific areas set up for interaction with the smart carrier wagon 102 to be able to carry out the pick-up / delivery of the semi-trailer 52 of the articulated vehicle 50 positioned on the platform 101a, as shown in Figure 3, and in the subsequent Figures 10-12.

[0020] Advantageously according to the invention, the smart carrier wagon comprises at least two locking systems 101f that rise during the displacement maneuvers of the wagon and are lowered during the loading maneuvers of the articulated vehicle 50 preventing the movement of the elevator wagon 101 and providing support for load support.

[0021] Advantageously according to the invention, the smart elevator wagon 101 comprises load sensors configured to detect the presence on board of a vehicle, to check the tolerability limits of the load, and to check the compatibility of the load distribution.

[0022] Advantageously according to the invention, the smart elevator wagon 101 comprises systems to aid loading and unloading operations and movement of the articulated vehicle 50 or the single drive 51.

[0023] According to a further aspect of the invention, the computerized system 123 located on the smart elevator wagon 101 is configured to interact with the computerized system of station, as described in the aforementioned patent application of the same Applicant, and to operate the raising / lowering of the loading platform 101a through the systems 101e, which are adapted to cause the switch of the platform 101a position from a next level position at the street level to an elevated position aligned to the height of the upper standard buffers of the usual railway wagons and viceversa, compatibly with data coming from on-board sensors, in particular of load sensors and other sensors.

[0024] The computerized system 123 also automatically manages the movement of the elevator wagon 101 to position itself in the maneuver or rest areas according to the indications received electronically from the station computerized system.

[0025] According to an aspect of the invention, the smart elevator wagon 101 includes a battery that can be recharged automatically installing an induction system in the where the wagon 101 operates, or positioning the wagon 101 in a specific area where the connection to the electricity network can be done in automatic or manual mode.

[0026] Figure 5 schematically shows the smart carrier wagon 102, in the sense that it comprises all the implementations present in the patent previously mentioned in the name of the same Applicant, comprising a linear structure equipped with two wheel systems 102aa among which a loading platform 102a is included configured to receive the semi-trailer 52 of the articulated vehicle 50 and configured to be lowered and raised, on command of the computerized system present on the wagon, so that it can be raised up to the level of the buffer 102ab level to allow horizontal transit of the semi-trailer 52.

[0027] According to an aspect of the invention, a first end of the carrier wagon 102 comprises a flat portion 102ca configured to house the front part of the semi-trailer 52 after it has been loaded onto the loading platform 102a, and to be able to lock it by means of an adjustable locking system 102cb. Moreover, the flat portion 102ca is equipped on each side with a tipping platform 102c for the passage of an operator.

[0028] The front part of the loading platform 102a positioned in correspondence of the parking stands of the semitrailer 52 when it is loaded, it is equipped with a self-leveling platform 102d to facilitate the support of the semi-trailer 52 during the loading or unloading phase to allow the disengagement of the drive.

[0029] In addition, to fix the semi-trailer 52 during transport, in addition to the lock system 102cb, there is also a rear-wheel lock system.

[0030] Eventually another locking system of the front wheels may also be present.

[0031] Advantageously according to the invention, the self-leveling platform 102d prevents the trucker from releasing and resting the parking stands on the ground-manually, for the release of the drive 51. With the automatism of the platform, the truck driver will have to limit himself to manually disable the connections (electrical and other installations) and finally unblock the drive 51.

[0032] With an automatic control of the electronic system of the wagon, the lowering of the self-leveling platform realizes the leveling of the semi-trailer 52 in the best position to carry out the transport.

[0033] Figure 6 shows the smart 102 with the smart carrier wagon 102 with the semitrailer 52 of the articulated vehicle 50 loaded on the loading platform 102a.

[0034] Advantageously according to the invention, the smart carrier wagon 102 comprises load sensors to de-

termine if the weight of the semitrailer is suitable for transport in relation to the characteristics of the railway section to be traveled.

[0035] Advantageously according to the invention, the smart carrier wagon 102 comprises systems to aid loading and unloading operations and movement of the articulated vehicle or the single drive.

[0036] Moreover, advantageously according to the invention, the stations can be equipped with an apparatus 104 for the automatic control of the shape of the wheeled vehicle, adapted to perform an automatic verification of the compatibility of silhouettes of wheeled vehicles loaded on the wagons, with the characteristics of the route of the railway network to be covered for delivery. In particular, such a verification apparatus 104 of the silhouettes of the loaded wagons can be implemented with sensors, cameras, or other detection systems detecting the shape of the objects.

[0037] According to a further aspect of the invention, the movements of all road and rail vehicles operating in the area in which the system 100 operates, are managed by the station computerized system which has the full and exclusive control of the area where are the tracks, when it is necessary to manage loading / unloading operations of wheeled vehicles.

[0038] Operationally, in the delivery phase from the road network to the railway network, the articulated vehicle 50, with the semi-trailer 52 to be loaded, is placed in a special area with tracks coplanar with the street plan. The driver of the articulated vehicle, accessing from his tablet or other similar systems present on the drive, through a specific application preloaded on the same tablet and which allows to interface telematically with the station computerized system, communicates its credentials to carry out the loading operation. After verification and acceptance of the credentials authorizing the loading of the semi-trailer 52, the smart elevator wagon 101 will be managed to move independently and, once it reaches the loading position, it will lower one of the tipping platforms 101b or 101c, which will act as a connection ramp to allow the articulated vehicle 50 to always go forward. The positioning of the elevator wagon 101 at a precise point of the tracks' asphalted area depends on the wagon that carries out the transport which is unidirectional since it allows operations only on one side. Consequently the access direction of the articulated vehicle 50 on board the elevator wagon 101 can take place only in a specific direction through the platforms 101b or 101c. Subsequently the tipping platform 101b or 101c is raised and by means of the systems 101e for lifting the loading platform 101a, is raised up to the height of the buffers 102ab of the carrier wagon, made to arrive automatically at the rear of the elevator wagon 101, where the semi-trailer must be moved. Then the tipping platform 101b or 101c is lowered again to form a corridor with the carrier wagon 102 and the articulated vehicle 50 is driven in reverse until it reaches the position suitable for transferring the semi-trailer 52 onto the smart carrier wagon 102.

[0039] According to an aspect of the invention, as shown in figure 7, the driveway road infrastructure 103 which allows access to a service binary 203 of the railway network connected to the railway line of the railway, includes a load / unload line 103a comprising unsurfaced binaries to be carriageable and connection elements 103b to the service binary 203.

[0040] In use, the methodology of operation of the system 100 shown in figures 8-14, comprises the steps of:

- 1) arriving in a railway station of an articulated vehicle 50, autonomous positioning of the smart elevator wagon 101 in the loading zone 103 of the vehicular road infrastructure 103, and made available for the smart carrier wagon 102;
- 2) closure during the entire loading operation and transfer of the semi-trailer of the pathway used for loading by the rail vehicles, approaching of the articulated vehicle 50 and lowering the first tipping plane 101b or 101c of the elevator wagon 101 according to the orientation of the carrier wagon 102;
- 3) loading the articulated vehicle 50 on the elevator wagon 101 and lifting the first tipping platform 101 or 101c;
- 4) positioning the smart carrier wagon 102;
- 5) Raising the platform of the elevator wagon with the articulated vehicle 50 on board;
- 6) Lowering the tipping platform 101b or 101c to create the passage corridor with the carrier wagon;
- 7) moving the articulated vehicle 50 on the smart carrier wagon 102 and release of the drive 51;
- 8) positioning the drive 51 on the elevator wagon, lifting the tilting platform 101b or 101c leveling the semitrailer by means of the platform 102d, blocking of the rear wheels and lowering of the semitrailer 52 placed on the platform 102a inside the smart carrier wagon 102;
- 9) lowering the platform 101a of the elevator wagon 101;
- 10) unloading the drive 51 and managing the exit of the same from the railway line;
- 11) moving the smart carrier wagon 102 towards a train in composition on the railway line.

[0041] More in detail, to load the semi-trailer 52 onto the carrier wagon 102, the elevator wagon 101 is positioned in the correct position to raise the entire articulated vehicle 50. So, the first tipping platform 101b or 101c is lowered to the ground, after the driver is positioned to stand on it and has provided the credentials to the station computerized system that coordinates all the operations, through a dedicated application, and the articulated vehicle 50 is loaded on the elevator wagon 101. The first tipping platform 101b or 101c is raised and then the platform 101a of the elevator wagon 101 is lifted. The carrier wagon 102 is appended empty to carry out the loading operation. As a result, the second tipping platform 101b or 101c of the elevator wagon 101 is lowered in corre-

spondence of the carrier wagon 102. The semitrailer 52 is loaded with its drive 51 in reverse, and, thereafter, the support 102d placed on the wagon platform to support the stands of the front of the trailer is elevated. Then the driving 51 is unlocked and is positioned on the elevator wagon 101. The first tipping platform 101b or 101c of the elevator wagon 101 is raised. After that a leveling of the semitrailer is made suitably lowering the support base of the stands, that is, the self-leveling platform 102d of the carrier wagon 102 with the blocking of the semi-trailer 52 by means of the towing nail with the device 102cb and the rear wheels with the locking devices. The carrier wagon 102 is then removed for stop in other area or insertion in a railway train. Then the elevator wagon 101 is lowered at street level and then positioned in good position (area for the disengagement of the drive in the asphalt travel direction). Following the second tipping platform 101b or 101c is lowered to allow the exit of the drive 51. Then the second tipping platform 101b or 101c of the elevator wagon 101 is raised when the elevator wagon 101 is moved to the rest area.

[0042] For the unloading of a semi-trailer arrived with another carrier wagon at the area 100, the elevator wagon 101 is positioned in the correct position to make only the drive 51 of the articulated vehicle 50 rises in the correct direction. Then the second tipping platform 101b or 101c for the connection to the ground of the elevator wagon 101 after the driver, who has already positioned himself to climb on it, has supplied the credentials through the app. Then the drive 51 is loaded on the elevator wagon 101. The first tipping platform 101b or 101c is raised and the platform of the elevator wagon 101 is raised too. The carrier wagon 102 is appended to carry out the unloading operation of the loaded semi-trailer 52. The second tipping platform 101b or 101c of the elevator wagon 101 is lowered on the carrier wagon 101 102 and the blocks of the semi-trailer 102cb and the blocks of the rear wheels are unhooked and the platform 102a of the carrier wagon is raised. Then the support 102d for the elevation of the semi-trailer stands is raised. The reversing of the drive 51 is performed to engage the semi-trailer 52 and subsequent forward exit of the articulated vehicle 50 (drive 51 and semitrailer 52) positioning on the elevator wagon 101, after the platform 102d of the carrier wagon 102 has been lowered. Then the second tipping platform 101b or 101c of the elevator wagon 101 is raised. The elevator wagon 101 is lowered to street level and positioned low down in good position (area for the disengagement of the articulated vehicle in the asphalted direction of travel). Then the second tipping platform 101b or 101c of elevator wagon 101 is lowered to allow the exit of the articulated and subsequently the second tipping platform 101b or 101c of the elevator wagon 101 and then be moved to a parking area.

[0043] With similar easily understandable maneuvers it is possible to load any wheeled vehicle onto carrier wagons 102, suitably configuring the wheel locking systems of the vehicles, at least two or more than two, on

the loading platform 102a.

[0044] Therefore, the loading system and transporting wheeled vehicles on railway network according to the invention facilitates the operations of maneuvering the drive of the articulated vehicle, since it allows the access of the articulated vehicle always in forward gear, making the maneuver very simple.

[0045] Another advantage of the loading system and transporting wheeled vehicles on railway network is to automatically perform the perfect alignment of the semi-trailer, which is the most complicated part of the loading operation in reverse.

[0046] Finally, the loading system and transporting wheeled vehicles on railway network according to the invention on a railway network is efficient and low cost.

[0047] Finally, it is clear that the loading system and transporting wheeled vehicles on railway network, and in particular of semi-trailers of articulated vehicles here described and illustrated may be subject to modifications and variations without thereby departing from the scope of the present invention, as defined in the appended claims.

25 Claims

1. System (100) for loading and transporting on railway network wheeled vehicles, the system (100) comprising:

- at least one loading wagon (101) configured to house a wheeled vehicle (50);

at least one carrier wagon (102) comprising a linear structure equipped with two wheel systems (102aa) between which a load platform (102a) is comprised configured to house the wheeled vehicle (50) and configured to be lowered and raised, in such a way as to be able to be raised up to allow horizontal transit of the wheeled vehicle (50); and

- a carriageable road infrastructure (103) for connecting the road network to a specific area comprising a railway network service binary (203) for use by the elevator wagon (101), the railway network being connected to the railway line of the same network, configured for allowing the access and the exit of the wheeled vehicle (50) in two travelling directions;

characterized in that:

- a computerized system is configured to be placed in a station of the railway network;

- the loading wagon is interfaced with the railway station computerized system and being an elevator wagon (101); the platform (101a) of said elevator wagon (101) being provided with a first

tipping plane (101b) hinged to a first end; a second tipping plane (101c) hinged to a second end opposite to the first one; lateral external containment fenders (121) configured to achieve perfect alignment of the wheeled vehicle (50); and a gangway (122) for the passage of an operator, sideways to the containment fenders (121);

whereby a linear structure (101d) to which the platform (101a) is inferiorly coupled, comprises, at its ends, carriages (101da) with motorized rooms; whereby lifting structures (101e) are fixed between the linear structure (101d) and the platform (101a) and configured to raise and lower the platform (101a) of the elevator wagon (101) by means of actuators, configured for switching the position of the platform (101a) from a level position close to the road level to a raised position aligned with the standard upper height of buffers of the usual railway wagons and vice versa, depending on the data provided by on board sensors;

whereby an electronic control system (123) is comprised in the linear structure (101d) and configured to interact with the railway station computerized system and operate the raising / lowering of the loading platform (101a) through the lifting systems (101e);

whereby auxiliary systems are provided to assist in loading and unloading maneuvers and in handling of the wheeled vehicle (50); - the carrier wagon (102) is interfaced with the railway station computerized system and comprises:

- a first end comprising a flat portion (102ca) configured to accommodate the front part of the wheeled vehicle (50) after being loaded on the loading platform (102), and to be able to lock it by means of an adjustable locking system (102cb), the flat portion (102c) being provided on each side with a tipping platform (102c) for the passage of an operator;

- load sensors to determine if the weight of the semi-trailer is suitable for transport in relation to the characteristics of the railway section to be covered;

- systems to assist in loading and unloading maneuvers and handling of the wheeled vehicle (50);

- the carriageable road infrastructure (103) comprises a loading / unloading area (103a) comprising unsurfaced tracks made carriageable and connecting elements (103b) to the service binary (203), which service binary is intended for use by the elevator wagon (101).

2. System (100) according to claim 1, **characterized in that** the electronic control system (123) is positioned between the lifting structures (101e).

3. System (100) according to claim 1, **characterized in that** the platform (101a) is configured to be operated in manual or automatic mode.

4. System (100) according to claim 1, **characterized by** the fact the elevator wagon (101) comprises at least two locking systems (101f) able to rise during the moving maneuvers of the wagon and to lower during the loading maneuvers of the wheeled vehicles (50) preventing the movement of the elevator wagon (101) and providing support for load support.

5. System (100) according to claim 1, **characterized in that** the elevator wagon (101) comprises load sensors configured to detect the presence of a vehicle on board, to check the tolerability limits of the load, and to check the compatibility of the load distribution.

6. System (100) according to claim 1, **characterized in that** the computerized system (123) is configured to automatically manage the moving of the elevator wagon (101) for positioning in the maneuvering areas or stop areas according to the information received electronically from the railway station computerized system.

7. System (100) according to claim 1, **characterized in that** the intelligent elevator wagon (101) comprises a battery rechargeable automatically or by connection to the electricity network.

8. System (100) according to claim 1, **characterized in that** the front part of the load platform (102a) faced to the loading side (102ca), placed at the stands of the semi-trailer (52) when it is loaded, it is equipped with a self-leveling platform (102d) to facilitate the support of the wheeled vehicle (50) during the loading or unloading phase.

Patentansprüche

1. System (100) zum Beladen und Transportieren von Radfahrzeugen für das Schienennetz, wobei das System (100) Folgendes umfasst:

- mindestens einen Ladewagen (101), der zum Aufnehmen eines Radfahrzeugs (50) ausgelegt ist;

mindestens einen Transportwagen (102) mit einer linearen Struktur mit zwei Radsystemen (102aa), zwischen denen sich eine Ladeplattform (102a) befindet, die das Radfahrzeug (50) aufnehmen kann

und abgesenkt und angehoben werden kann, um einen horizontalen Transport des Radfahrzeugs (50) zu ermöglichen; und

- eine Fahrstreckeninfrastruktur (103) zum Verbinden des Straßennetzes mit einem bestimmten Bereich, der eine Schienennetz-Wartungsstation (203) für den Aufzugswagen (101) umfasst, wobei das Schienennetz mit der Schienenstrecke desselben Netzes verbunden ist, so dass die Zu- und Ausfahrt des Radfahrzeugs (50) in zwei Fahrrichtungen ermöglicht wird;

dadurch gekennzeichnet, dass

- ein computergestütztes System so konfiguriert ist, dass es in einem Bahnhof des Schienennetzes installiert werden kann;

- der Ladewagen mit dem Computersystem des Bahnhofs verbunden und ein Aufzugswagen (101) ist; die Plattform (101a) des Aufzugswagens (101) mit einer ersten Kippebene (101b) versehen ist, die an einem ersten Ende mit einem Scharnier angebracht ist; dass eine zweite Kippebene (101c), an einem zweiten, dem ersten Ende gegenüberliegenden Ende mit einem Scharnier angebracht ist; dass seitliche äußere Begrenzungsflächen (121) vorhanden sind, die eine perfekte Ausrichtung des Radfahrzeugs (50) ermöglichen; und dass seitlich an den Begrenzungsflächen (121) ein Durchgang (122) für den Bediener vorhanden ist;

wobei weiter unten an der Plattform (101a) eine lineare Struktur (101d) angebracht ist, die an den Enden Wagen (101da) mit motorisierten Räumen aufweist; wobei zwischen der linearen Struktur (101d) und der Plattform (101a) Hebestrukturen (101e) befestigt und so konfiguriert sind, dass sie die Plattform (101a) des Aufzugswagens (101) mithilfe von Aktuatoren anheben und absenken, die die Position der Plattform (101a) von einer ebenen Position nahe dem Straßenniveau in eine angehobene Position wechseln, die an der standardmäßigen Oberkante der Puffer üblicher Eisenbahnwagen ausgerichtet ist, wobei dieser Vorgang abhängig von den von den Bordsensoren bereitgestellten Daten und umgekehrt werden kann; wobei die lineare Struktur (101d) ein elektronisches Steuerungssystem (123) umfasst, das mit dem computergestützten System des Bahnhofs interagiert und das Anheben/Absenken der Ladeplattform (101a) über die Hebesysteme (101e) steuert;

wobei Hilfssysteme vorgesehen sind, die bei den Be- und Entladevorgängen sowie beim Handhaben des Radfahrzeugs (50) Unterstützung bieten; - der Transportwagen (102) mit

dem Computersystem des Bahnhofs verbunden ist und Folgendes umfasst:

- ein erstes Ende, das einen flachen Abschnitt (102ca) umfasst, der den vorderen Teil des Radfahrzeugs (50) aufnimmt, nachdem dieses auf die Ladeplattform (102) geladen wurde, und das mithilfe eines einstellbaren Verriegelungssystems (102cb) verriegelt werden kann, wobei der flache Abschnitt (102c) auf beiden Seiten mit einer Kippplattform (102c) als Durchgang für den Bediener versehen ist;

- Lastsensoren, um festzustellen, ob das Gewicht des Sattelzugs im Bezug auf die Eigenschaften der zu befahrenden Bahnstrecke für den Transport geeignet ist;

- Systeme zur Unterstützung von Be- und Entladevorgängen und der Handhabung des Radfahrzeugs (50);

- die Fahrstreckeninfrastruktur (103) einen Be-/Entladebereich (103a) umfasst, der unbefestigte, befahrbar gemachte Gleise und Verbindungselemente (103b) zu der für die Nutzung durch den Aufzugswagen (101) vorgesehenen Wartungsstation (203) umfasst.

2. System (100) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das elektronische Steuerungssystem (123) zwischen den Hebestrukturen (101e) angeordnet ist.

3. System (100) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Plattform (101a) so konfiguriert ist, dass sie im manuellen oder automatischen Modus betrieben werden kann.

4. System (100) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Aufzugswagen (101) mindestens zwei Verriegelungssysteme (101f) umfasst, die sich während der Bewegungsvorgänge des Wagens heben und während der Beladevorgänge der Radfahrzeuge (50) senken, um eine Bewegung des Aufzugswagens (101) zu verhindern und die Lastträger zu unterstützen.

5. System (100) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Aufzugswagen (101) Lastsensoren umfasst, die das Vorhandensein eines Fahrzeugs an Bord erkennen und die Toleranzgrenzen der Last sowie die Kompatibilität der Lastverteilung prüfen.

6. System (100) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das computergestützte System (123) die Bewegung des Aufzugswagens (101) zur Positionierung in den Manövrier- oder Haltebereich

chen gemäß den elektronisch vom computerge-
stützten System des Bahnhofs abgerufenen Daten
automatisch steuert.

7. System (100) gemäß Anspruch 1, **dadurch gekenn-
zeichnet, dass** der intelligente Aufzugswagen (101)
eine Batterie umfasst, die automatisch oder durch
Anschließen an das Stromnetz wiederaufgeladen
werden kann. 5
8. System (100) gemäß Anspruch 1, **dadurch gekenn-
zeichnet, dass** der der Beladungsseite (102ca) zu-
gewandte und an an den Ständern des Sattelanhän-
gers (52) angebrachte vordere Teil der Ladeplatt-
form (102a) beim Beladen eine selbstnivellierende
Plattform (102d) umfasst, um das Abstützen des
Radfahrzeugs (50) in der Be- oder Entladephase zu
erleichtern. 10

Revendications

1. Système (100) pour charger et transporter sur le ré-
seau ferroviaire des véhicules à roues, le système
(100) comprenant : 15
- au moins un wagon de chargement (101) con-
figuré
pour accueillir un véhicule à roues (50) ;
au moins un wagon porteur (102) comprenant 20
une structure linéaire équipée de deux systè-
mes de roues (102aa) entre lesquels est com-
prise une plate-forme de chargement (102a)
configurée pour loger le véhicule à roues (50)
et configurée pour être abaissée et relevée, de
manière à pouvoir être relevée pour permettre
le transit horizontal du véhicule à roues (50) ; et 25
 - une infrastructure routière transportable
(103) pour connecter le réseau routier à une
zone spécifique comprenant un binaire de
service de réseau ferroviaire (203) destiné
à être utilisé par le wagon élévateur (101),
le réseau ferroviaire étant connecté à la li-
gne ferroviaire du même réseau, configuré
pour permettre l'accès et la sortie du véhi-
cule à roues (50) dans deux directions de
déplacement ; 30
- caractérisé en ce que :** 35
- un système informatisé est configuré pour être
placé dans une gare du réseau ferroviaire ;
- le wagon de chargement est interfacé avec le
système informatisé de la gare ferroviaire et
étant un wagon élévateur (101) ; la plate-forme
(101a) dudit wagon élévateur (101) étant pour-
vue d'un premier plan de basculement (101b)
articulé à une première extrémité ; d'un second 40

plan de basculement (101c) articulé à une se-
conde extrémité opposée à la première ; des
ailes de retenue externes latérales (121) confi-
gurées pour obtenir un alignement parfait du vé-
hicule à roues (50) ; et une passerelle (122) pour
le passage d'un opérateur, latéralement aux
ailes de retenue (121) ; dans lequel une struc-
ture linéaire (101d) à laquelle la plate-forme
(101a) est inférieurement couplée, comprend, à
ses extrémités, des chariots (101da) avec des
pièces motorisées ;
dans lequel des structures de levage (101e) sont
fixées entre la structure linéaire (101d) et la pla-
te-forme (101a) et configurées pour lever et
abaissier la plate-forme (101a) du wagon éléva-
teur (101) au moyen d'actionneurs, configurés
pour commuter la position de la plate-forme
(101a) d'une position de niveau proche du ni-
veau de la route à une position levée alignée
avec la hauteur supérieure standard des tam-
pons des wagons ferroviaires habituels et vice
versa, en fonction des données fournies par les
capteurs embarqués ;
dans lequel un système de commande électro-
nique (123) est compris dans la structure linéaire
(101d) et configuré pour interagir avec le systè-
me informatisé de la gare et faire fonctionner
l'élévation/abaissement de la plate-forme de
chargement (101a) par l'intermédiaire des systè-
mes de levage (101e) ;
où des systèmes auxiliaires sont prévus pour
aider aux manœuvres de chargement et de dé-
chargement et à la manipulation du véhicule à
roues (50) ; - le wagon porteur (102) est interfa-
cé avec le système informatisé de la gare et
comprend : 45

- une première extrémité comprenant une
partie plate (102ca) configurée pour rece-
voir la partie avant du véhicule à roues (50)
après son chargement sur la plate-forme de
chargement (102), et pour pouvoir la ver-
rouiller au moyen d'un système de ver-
rouillage réglable (102cb), la partie plate
(102c) étant pourvue de chaque côté d'une
plate-forme basculante (102c) pour le pas-
sage d'un opérateur ;
- des capteurs de charge pour déterminer
si le poids de la semi-remorque est adapté
au transport en fonction des caractéristi-
ques du tronçon ferroviaire à parcourir ;
- des systèmes pour faciliter les manœuvres
de chargement et de déchargement et
la manipulation du véhicule à roues (50) ;
- l'infrastructure routière carrossable (103)
comprend une zone de chargement/dé-
chargement (103a) comprenant des voies
non revêtues rendues carrossables et des 50

- éléments de connexion (103b) au binaire de service (203), lequel binaire de service est destiné à être utilisé par le wagon élévateur (101). 5
2. Système (100) selon la revendication 1, **caractérisé en ce que** le système de commande électronique (123) est positionné entre les structures de levage (101e). 10
3. Système (100) selon la revendication 1, **caractérisé en ce que** la plate-forme (101a) est configurée pour fonctionner en mode manuel ou automatique.
4. Système (100) selon la revendication 1, **caractérisé par le fait que** le wagon élévateur (101) comprend au moins deux systèmes de verrouillage (101f) capables de s'élever pendant les manœuvres de déplacement du wagon et de s'abaisser pendant les manœuvres de chargement des véhicules à roues (50) empêchant le déplacement du wagon élévateur (101) et fournissant un support pour le support de la charge. 15
20
5. Système (100) selon la revendication 1, **caractérisé en ce que** le wagon élévateur (101) comprend des capteurs de charge configurés pour détecter la présence d'un véhicule à bord, pour vérifier les limites de tolérance de la charge, et pour vérifier la compatibilité de la répartition de la charge. 25
30
6. Système (100) selon la revendication 1, **caractérisé en ce que** le système informatisé (123) est configuré pour gérer automatiquement le déplacement du wagon élévateur (101) pour un positionnement dans les zones de manœuvre ou les zones d'arrêt selon les informations reçues électroniquement du système informatisé de la gare. 35
7. Système (100) selon la revendication 1, **caractérisé en ce que** le wagon élévateur intelligent (101) comprend une batterie rechargeable automatiquement ou par connexion au réseau électrique. 40
8. Système (100) selon la revendication 1, **caractérisé en ce que** la partie avant de la plate-forme de chargement (102a) tournée vers le côté de chargement (102ca), placée au niveau des béquilles de la semi-remorque (52) lorsqu'elle est chargée, est équipée d'une plate-forme autonivelante (102d) pour faciliter le support du véhicule à roues (50) pendant la phase de chargement ou de déchargement. 45
50

55

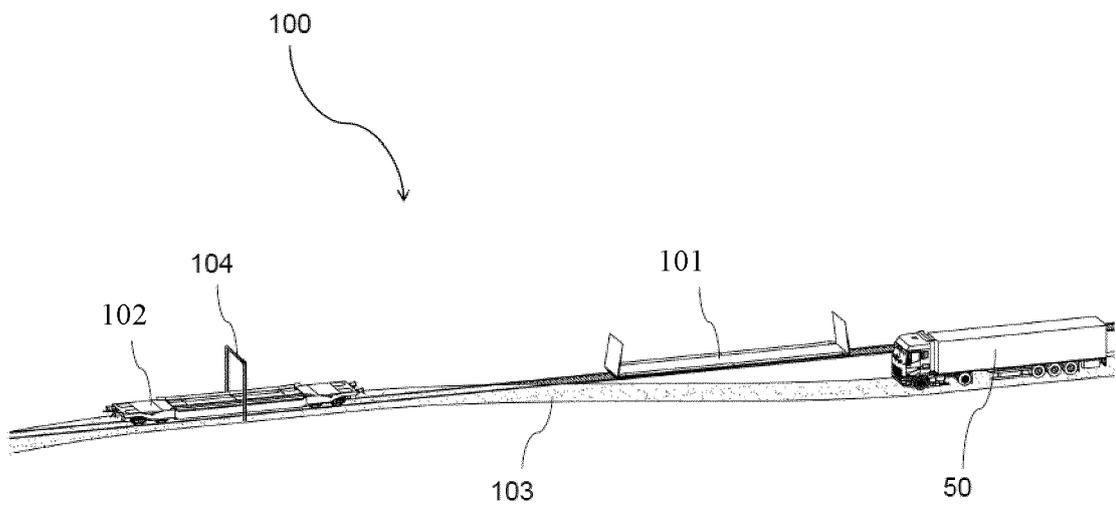


Fig. 1

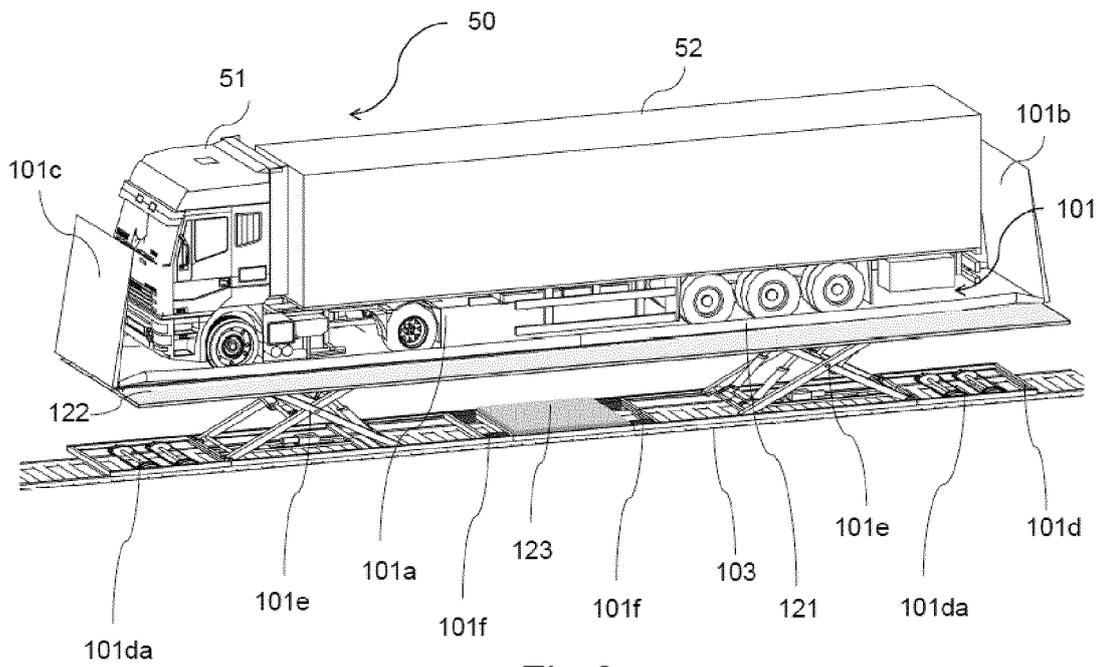


Fig. 2

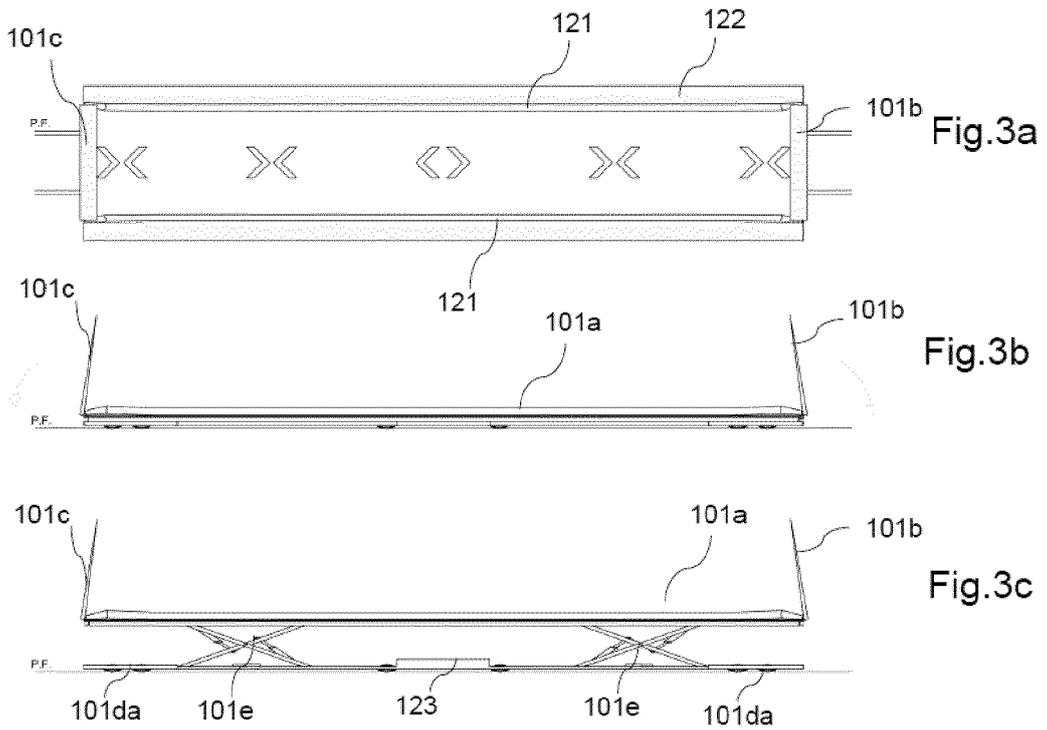


Fig. 3

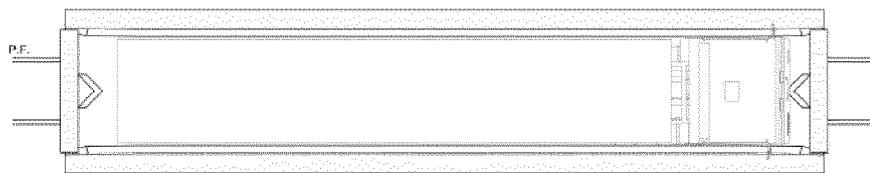


Fig.4a

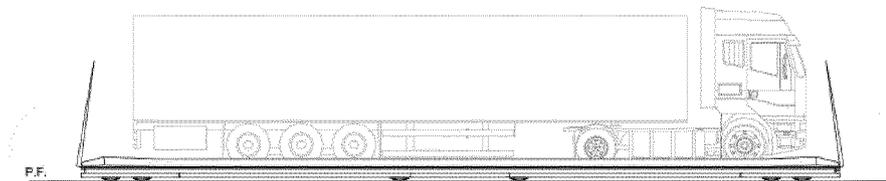


Fig.4b

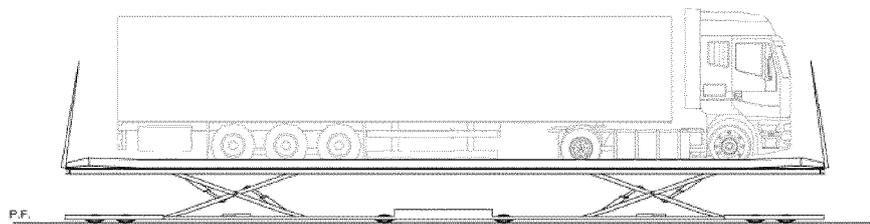


Fig.4c

Fig. 4

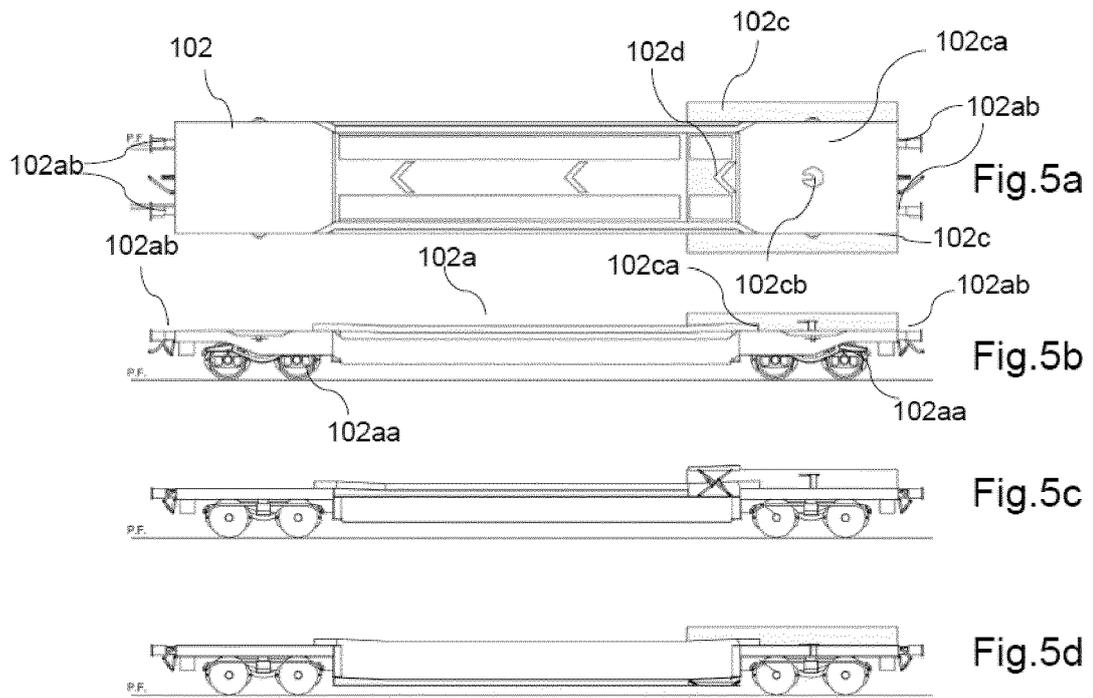


Fig. 5

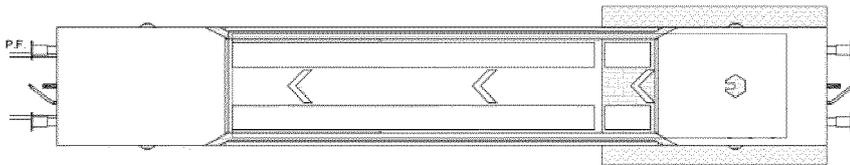


Fig.6a

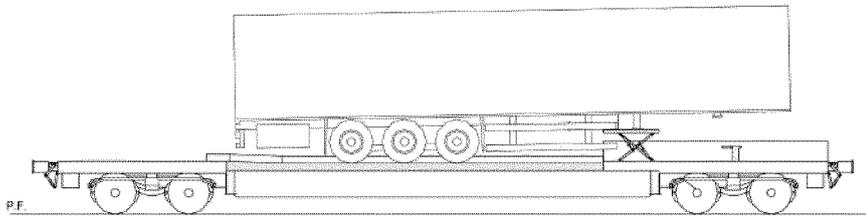


Fig.6b

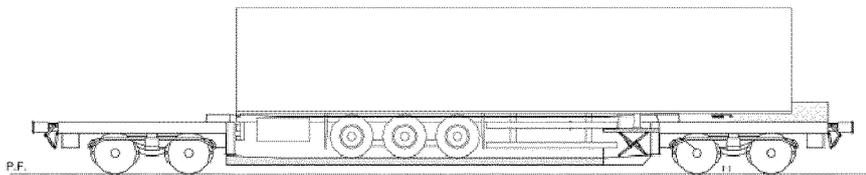


Fig.6c

Fig. 6

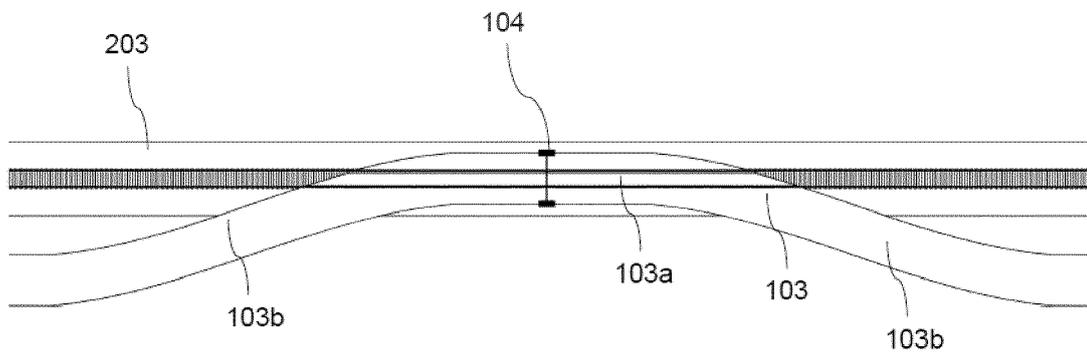


Fig. 7

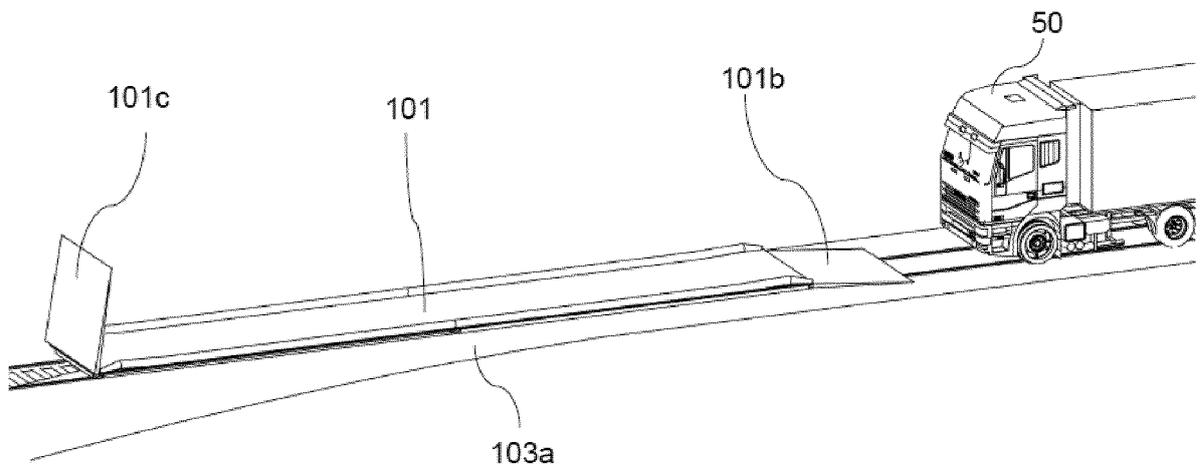


Fig. 8

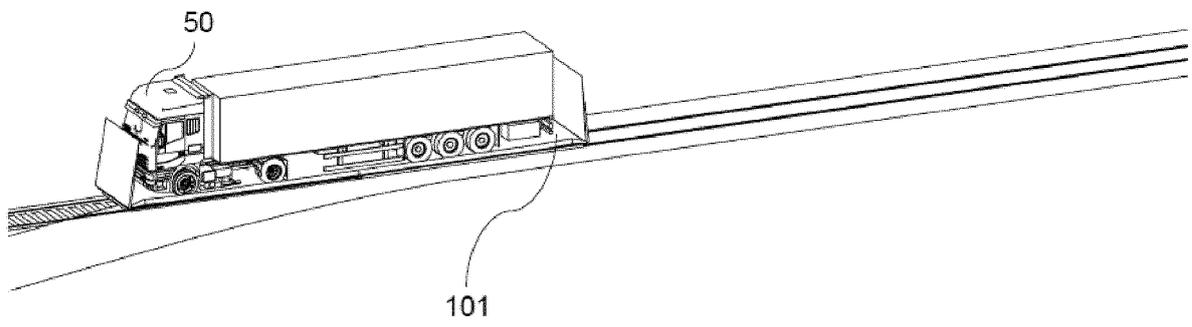


Fig. 9

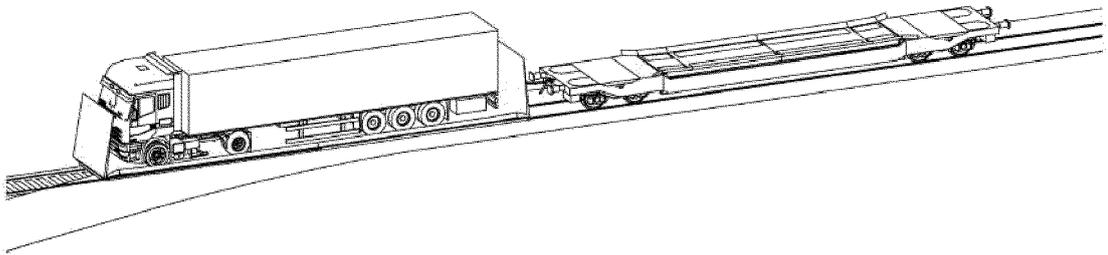


Fig. 10

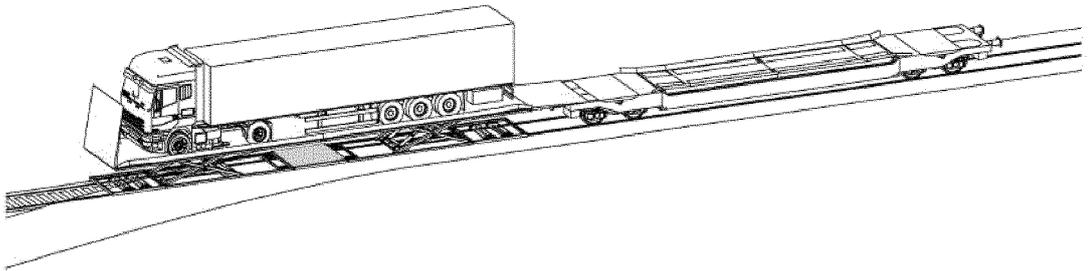


Fig. 11

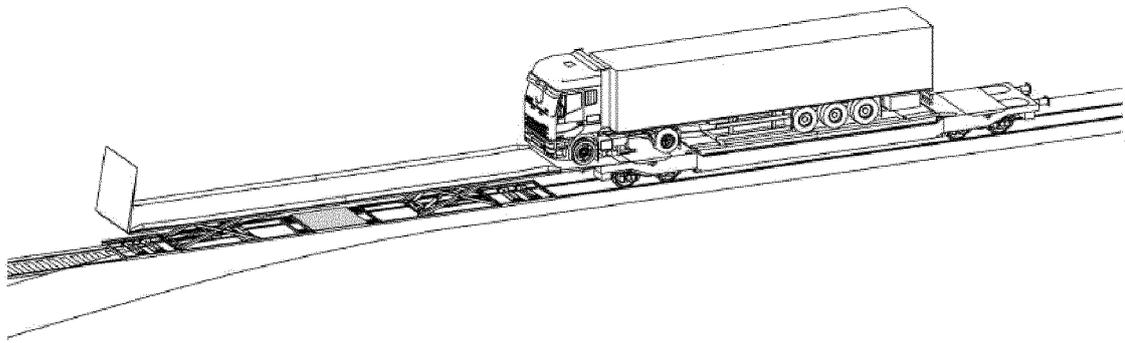


Fig. 12

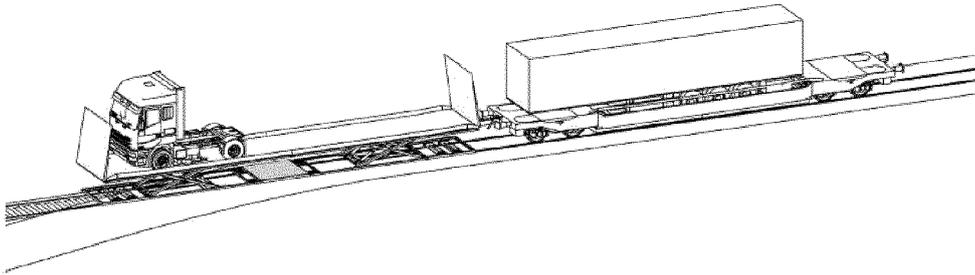


Fig. 13

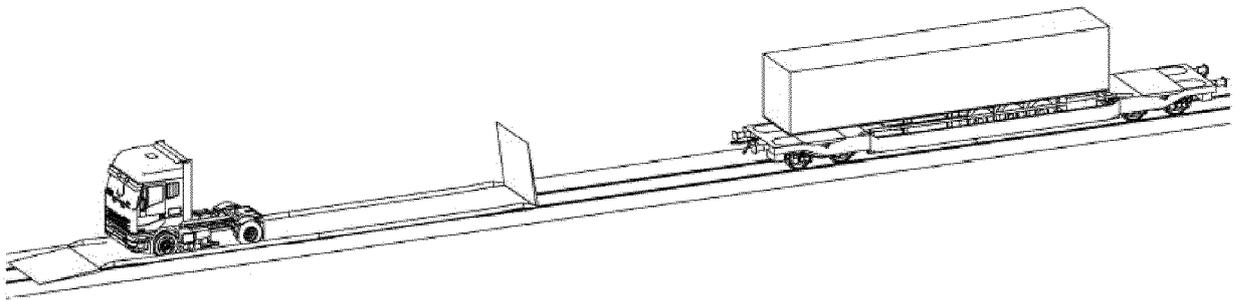


Fig. 14

REFERENCES CITED IN THE DESCRIPTION

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