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(54) Benævnelse: **BEVÆGELIGE TRANSPORTØRER BEREGNET TIL FLYTNING AF ET FIRHJULET KØRETØJ**

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CN-Y- 2 399 477
DE-B- 1 045 075
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US-A1- 2010 086 385

Description

Field of the invention

[0001] The present invention relates to the field of movable conveyors for moving a four-wheeled vehicle, in particular—but not exclusively—for automatic vehicle parking or for moving motor vehicles during manufacture.

[0002] Conveyors of this type generally comprise a movable frame fitted with a pair of forks that are slid under the vehicle and then raised so that the vehicle wheels no longer come into contact with the ground. The conveyor can then move the vehicle to a new location, where it is set down by lowering and removing the forks.

State of the art

[0003] European patent EP2614198, which describes a device for storing a motor vehicle that is able to move transversely in relation to its longitudinal axis on a storage site, is known in the state of the art. This driverless device comprises a motorized frame that is parallel to the longitudinal axis of the vehicle. A pair of forks are moved horizontally to fit in on one side of the vehicle wheels.

[0004] Also known is German patent DE1228390, which describes a device consisting of a platform supporting two transversely movable straddle arms, each extended by movable lateral arms so as to come into contact with the tread of each wheel. This platform is mounted on castors for moving the vehicle along a path formed in a pit. DE1045075B describes another state-of-the-art conveyor.

[0005] Chinese utility model CN2399477 describes a parking device in accordance with the preamble of claim 1, consisting of a straddle arm of constant length supporting a first fixed sub-frame and two movable sub-frames each actuated by a cylinder.

[0006] Also known is patent application WO2005/059276, which describes a truck and a parking system using this truck to transport automobiles and the like. The truck of the present invention comprises a main body that can be moved; and a locking means having at least a first and a second movable plate and at least one pair of locking jaws. The parking system of the present invention comprises a loading table, a differential table that is movable in relation to the loading table, a truck that is movable in relation to the differential table, a longitudinal drive mechanism, a linear power tube transmission mechanism, and a motorized valve station combined with an

electrical control system. The truck of the present invention has a simple structure and facilitates flexible and automatic positioning, it allows locking and lifting of automobiles or vehicle frames of various wheelbases, and it allows bidirectional transport as well as stowage or retrieval of automobiles.

[0007] Also known is patent application US2010/0086385, which describes another example of a device for moving a vehicle within a parking lot.

Drawbacks of the prior art

[0008] The side-loading solution of the type described in patent EP2614198 requires a large space on the side of the vehicle to make it possible to move the transport device close, position it parallel to the vehicle and actuate the forks that lift the vehicle.

[0009] The solution described in German patent DE1228390 involves a height of the assembly, formed by the platform, the longitudinal straddle arms and the castors, that makes it impossible to slide under modern vehicles whose ground clearance does not exceed a few centimeters.

[0010] The solution described by utility model CN2399477 requires two sub-frames to be moved, with two independent cylinders, each of these sub-frames having castors, making it very difficult to move and guide the device. However, the maneuverability of the device is essential for an application such as vehicle storage in a parking lot, and requires the ability to move with very small radii of curvature. The solution proposed by utility model CN2399477 allows movement in a straight line, or at best with a very large turning radius, making it impossible to move in restricted spaces such as a parking lot where it is sought to optimize space and increase vehicle density.

[0011] These prior-art solutions are therefore not suitable for driverless movement of a four-wheeled vehicle in a simple, robust and reliable manner.

Solution provided by the invention

[0012] In order to address these drawbacks, the present invention relates, in its most general sense, to a conveyor according to claim 1 for moving four-wheeled vehicles, comprising a frame provided with arms that are movable between a position in which they allow the movement of said frame under the vehicle, and a position in which they come into contact with the treads of said wheels, characterized in that said frame is telescopic and comprises two segments each carrying a pair of arms,

- at least one of the pairs of arms being articulated to allow movement between a position perpendicular to the longitudinal axis of the frame with an extension at least equal to the track of the vehicle, and a folded-up position to occupy a width that is less than the distance between the inner sides of the vehicle wheels,

- said segments being movable between a position where the arms are not in contact with the wheels, and a position in which each arm makes contact with the tread of one of said wheels, to raise or lower the vehicle.

[0013] The height of the frame and the elements that it supports, for the part intended to be engaged under the vehicle to be transported, is determined to be less than the ground clearance of the vehicle.

[0014] In a first variant, said pair of articulated arms is movable transversely.

[0015] According to the invention, said pair of articulated arms is movable through pivoting.

[0016] In a first mode of implementation, said raising of the vehicle is ensured by the interaction, on each side of the vehicle, between the rear arm with the rear of the zone of the rear wheel tread and between the front arm with the front of the zone of the front wheel tread.

[0017] Within the meaning of the present patent, the term “rear” is to be understood in relation to the conveyor's normal direction of travel. When the vehicle is loaded “back to front” the front wheels of the vehicle will be referred to as the “rear wheels” within the meaning of the present patent.

[0018] In a second mode of implementation, said raising of the vehicle is ensured by the interaction, on each side of the vehicle, between the rear arm with the front of the zone of the rear wheel tread and between the front arm with the rear of the zone of the front wheel tread.

[0019] In another mode of implementation, said raising of the vehicle is ensured by the interaction between one of said arms with one of the parts of the tread of a wheel and an additional arm coming into contact with an opposite part of the tread of the same wheel.

[0020] The invention also relates to an automatic parking system according to claim 7 comprising at least one conveyor according to one of claims 1 to 6 for moving four-wheeled vehicles, comprising a frame provided with movable arms that are movable between a position in which they allow the movement of said frame under the vehicle, and a position in which they come into contact with the treads of said wheels, characterized in that said frame is telescopic and comprises two segments each carrying a pair of arms,

- at least one of the pairs of arms being articulated to allow movement between a position perpendicular to the longitudinal axis of the frame with an extension at least equal to the track of the vehicle, and a folded-up position to occupy a width less than the distance between the inner sides of the wheels of the vehicle,

- said segments being movable between a position in which the arms are not in contact with the wheels, and a position in which each arm comes into contact with the tread of one of said wheels, to ensure the raising or the lowering of the vehicle.

[0021] Advantageously, said automatic parking system according to the preceding claim is characterized in that it comprises a computer for controlling the movement of the conveyor under the frame of a vehicle, by means of moving said conveyor along the longitudinal axis of said vehicle, then raising the vehicle by moving said segments and arms of the conveyor, then moving the conveyor to a destination location, then releasing the vehicle by moving the arms and removing the conveyor by means of a movement along the longitudinal axis of the vehicle.

Detailed description of non-limiting examples of the invention

[0022] The present invention will be better understood upon reading the following detailed description, which refers to non-limiting exemplary embodiments that are illustrated by the accompanying drawings, in which:

- Fig. 1 is a schematic perspective view of a conveyor according to an exemplary embodiment of the invention.

- Fig. 2 to 8 are schematic views of the vehicle and of the conveyor in successive loading steps.

- Fig. 9 is a perspective view corresponding to an alternative embodiment of the invention.

- Fig. 10 to 11 are schematic views corresponding to the alternative embodiment of the invention in Fig. 9.

[0023] Fig. 1 is a perspective view of an exemplary conveyor according to the invention. It comprises a front unit (1) containing a motor driving a single steering wheel (alternatively, two steering wheels may be provided). This front unit (1) also contains the electronic circuits and a computer handling the autonomous guidance of the conveyor. This front unit (1) has a wide-angle laser telemeter (10) mounted thereon providing real-time information to the computer.

[0024] This front unit (1) is extended toward the rear by a telescopic arm (2). A retractable part (3) of this arm is actuated by a cylinder or a linear actuator, for example a worm gear.

[0025] The first segment of the arm (2) has a front transverse arm (25) that is fixed and that supports two fixed extensions (21, 22), as well as two retractable extensions (23, 24), rotatable in relation to pivots (26, 27). They are driven by cylinders, so as to move between a cleared position, when the vehicle is being loaded, and a retracted locking position, when the vehicle is being transported. In the retracted position, the spacing of the extensions (21, 23) and (22, 24) is determined so as to come into contact with the front and rear sides of the vehicle tire and, by gripping, to ensure that it is raised. For this purpose, the front extensions (21, 23) have an inclined ramp (28, 29).

[0026] When the extensions (22, 23) are folded into the locking position, they prevent the vehicle from moving in relation to the conveyor.

[0027] The rear part (3) of the arm (2) also comprises a transverse arm (35) extended by two extensions (31, 32) that can be moved in relation to pivots (36, 37). When the vehicle is being loaded, these extensions (31, 32), as well as extensions (21, 22), are oriented substantially longitudinally, parallel to the main axis of the arm (2). The length L of the arms (25, 35), measured respectively between pivots (26, 27) and (36, 37), is less than $V_{min}-L_{min}$, where:

- v_{min} denotes the usual and minimal track of a car, typically 1600 millimeters

- L_{min} denotes the usual width of a car's tire, typically 220 millimeters.

[0028] The length L of the arms is therefore typically less than 1400 millimeters, and preferably of the order of 1200 millimeters.

[0029] The length of the fixed (21, 22) and movable (23, 24), (33, 34) extensions is determined to be half the width I_{max} corresponding to the width of a large car minus the length of the arm (25, 35), typically 500 millimeters for each of the extensions.

[0030] The conveyor can thus be positioned on the axis of the vehicle to allow free passage of the arm (2) under the vehicle frame with the extensions (23, 24, 33, 34) in a folded position,

oriented substantially longitudinally, until the ramps (28, 29) of the fixed arms (20, 21) come to rest against the front wheels of the vehicle. The extension (3) of the arm (2) is moved so as to be adapted to the wheelbase of the car to be loaded. The extensions (23, 24, 33, 34) are then moved so as to come into a transverse position, in contact with the rear sides of the vehicle wheels.

[0031] The extension (3) is then driven forward to ensure that the vehicle wheels are locked.

[0032] The front unit (1) comprises four ultrasonic telemetry sensors (41 to 44) delivering signals as a function of the distance from the vehicle bumper.

[0033] The front arm (25) comprises two force sensors ((46, 47) to detect and confirm that the vehicle has been grasped.

[0034] The rear arm (35) includes two short-range scanning laser telemetry sensors (48, 49) to detect the wheels and any obstacles.

[0035] The frame formed by the arm (2, 3) and the arms (25, 35) has castors or rollers to allow rolling on the ground.

[0036] Fig. 2 to 8 are schematic views of the vehicle and of the conveyor in successive loading steps.

[0037] Initially, as is shown in Fig. 2, the conveyor is positioned correctly in front of the car, which is parked in a storage location. The movable arms (22, 23, 32, 33) are folded into a longitudinal position.

[0038] The laser telemeter (10) provides the information for controlling the positioning of the conveyor. The short-range laser telemeters (46, 47) detect the front wheels of the vehicle. The conveyor aligns itself with the car.

[0039] In the next step (Fig. 3), the conveyor positions the arm (2) under the car, with longitudinal alignment of the axis of the arm (2) and the longitudinal axis of the vehicle. The ultrasonic telemeters (41 to 43) detect the vehicle bumper to control the stopping of the conveyor's relative movement in relation to the vehicle.

[0040] The short-range laser telemeters (48, 49) detect the rear wheels of the vehicle.

[0041] In the next step (Fig. 4), the movable rear extensions (32, 33) are retracted into a transverse position.

[0042] The conveyor then advances until the fixed forward extensions (22, 23) come back into contact with the front wheels (Fig. 5). The arm (2) adjusts its length as a function of the length of the front overhang estimated by the ultrasonic telemeters (41 to 44).

[0043] The force sensors (46, 47) indicate that the wheels are in contact.

[0044] The conveyor then adjusts (Fig. 6) the length of the rear arm (3) so that the rear extensions (32, 33) touch the rear wheels. The force sensors (48, 49) indicate that the wheels are in contact.

[0045] The movable extensions (23, 24) clamp the front wheels and raise the car onto the front and rear rollers (Fig. 7), causing the vehicle to rise.

[0046] The force sensors (48, 49) confirm that the car is mounted on the rollers (Fig. 8), and the conveyor is moved automatically to take the vehicle to the target location. The laser telemeter (10) detects obstacles. It performs an emergency stop of the robot if necessary.

Alternative embodiment

[0047] Fig. 9 and 11 show an alternative embodiment in which the vehicle is lifted using lifting bags (200, 300).

[0048] The conveyor consists of a frame formed of two casings (2, 3) about 50 millimeters thick, connected by a pair of ROLLON (trade mark) circulating ball profiled rails (250, 260). The frame thus forms a retractable platform consisting of a first segment (2) integral with the motorized unit (1) and a second segment (3) that can be moved away under the action of an electric or pneumatic cylinder using the circulating ball profiled rails (250, 260).

[0049] The frame thus only consists of two parts, which are retractable to allow it to be adapted to the wheelbase of the vehicle to be moved.

[0050] The segment (3) is provided with a pivoting plate (300) comprising free-moving castors (301, 302). A lifting bag or mechanism is inserted between the structure of the segment (3) and the plate (300) so as to allow variation in height between a collapsed position, in which the segment (3) can be slid under the vehicle, and a raised position, in which it makes it possible to lift the vehicle in such a way that its wheels leave contact with the ground.

[0051] The amplitude of the movement is typically a few centimeters.

[0052] The lifting bag consists, for example, of an inflatable envelope comprising two rectangular sheets of woven polyaramid. A pneumatic valve is inserted into a corner of the envelope.

[0053] Alternatively, the plate (300) is connected to the structure of the segment (3) by an extensible means such as a hydraulic oil jack or electric jack, with an articulated structure that can, for example, be deformed by a screw driven by an electric motor.

[0054] In the same way, the assembly formed by the motorized unit (1) and the segment (2) comprises a plate (200) mounted on a lifting bag or structure. The plate (200) is equipped with drive wheels (201, 202).

[0055] Alternatively, the assembly formed by the motorized unit (1) and the segment (2) comprises drive wheels (201, 202) consisting of drive units as described in European patent

EP1795431. These drive units (201, 202) are provided with a steering motor comprising a steering motor shaft and an orientable drive mechanism consisting of an electric motor, a gearbox and a brake.

[0056] Alternatively, the segment (2) is combined with a pulling-pushing drawbar by means of a height adjustment mechanism.

[0057] In all cases, the lifting mechanism controls the ground clearance of the first segment (2) so as to allow variation in height between a collapsed position, in which the segment (2) can be slid under the vehicle, and a raised position, in which it makes it possible to lift the vehicle in such a way that its wheels are no longer in contact with the ground. The amplitude of the movement is typically a few centimeters.

[0058] The segment (3) forms a hollow casing having on each side a pair of arms (31, 33; 32, 34) articulated respectively about pivots (310, 330; 320, 340) between a position in which the arms are folded to occupy a substantially longitudinal position, at an angle of less than 20° to the longitudinal axis, so as to reduce the width of the conveyor and allow it to be slid under the vehicle, between the wheels. In the retracted position, the arms (31, 33; 32, 34) extend perpendicular to the longitudinal axis. In this latter position, the inner edges of each arm rest against the tread of the car tire. When the lifting system is actuated, it causes the tires to lose contact with the ground.

[0059] The movement of the arms (21, 33; 32, 34) is provided by hydraulic, pneumatic or electric cylinders (311, 331; 321, 341).

[0060] The segment (2) also forms a hollow casing having on each side a fixed arm (21, 22) and a movable arm (23, 24) hinged respectively about pivots (230, 240) between a position in which the arms are folded to occupy a substantially longitudinal position, at an angle of less than 20° to the longitudinal axis, so as to reduce the width of the conveyor and allow it to be slid under the vehicle, between the wheels. In the retracted position, the arms (21, 23; 22, 24) extend perpendicular to the longitudinal axis. In this latter position, the inner edges of each arm rest against the tread of the car tire. When the lifting system is actuated, it causes the tires to lose contact with the ground.

[0061] The movement of the arms (23, 24) is provided by hydraulic, pneumatic or electric cylinders (231, 241).

[0062] The movement of the segment (3) in relation to the segment (2) makes it possible to adapt the conveyor to the wheelbase of each vehicle.

Patentkrav

1. Transportør til flytning af firhjulede køretøjer, hvilken transportør omfatter et chassis (2, 3) forsynet med indtrækbare sideforlængelser (23, 24, 32, 31), der kan bevæges mellem en position, hvori de muliggør flytning af chassiset under køretøjet, og en position, hvori de kommer i kontakt med hjulenes slidbane, hvilken transportør er således, at chassiset (2, 3) er teleskopisk og omfatter to segmenter (2, 3), der hvert bærer et par arme (25, 35),

- hvor mindst ét af armparrene (25, 35) er leddelt for at muliggøre en flytning mellem en position vinkelret på chassisets længdeakse med en forlængelse, der mindst svarer til køretøjets sporvidde, og en sammenfoldet position for at optage en bredde, der er mindre end afstanden mellem køretøjets indvendige hjulflanker,
- hvilke segmenter (2, 3) kan bevæges mellem en position, hvor armene ikke er i kontakt med hjulene, og en position, hvor hver arm kommer i kontakt med slidbanen på ét af hjulene, for at sikre hævning og sænkning af køretøjet,
- det leddelte armpar (25, 35) kan bevæges ved drejning af forlængelserne (23, 24, 31, 32), hvilken transportør er **kendetegnet ved, at**
- transportøren omfatter en forblok (1), der indeholder en motor, som driver ét eller to styrende hjul, forblokken (1) indeholder ligeledes de elektroniske kredsløb og en computer, der sikrer selvstændig styring af transportøren,
- der på forblokken (1) er monteret en vidvinklet laserafstandsmåler (10), som leverer informationer til computeren i realtid.

2. Transportør ifølge krav 1, **kendetegnet ved, at** køretøjets hævning eller sænkning sikres af et første løftemiddel placeret mellem det første segment (2) og en første plade, der bærer et første rullesystem, og et andet løftemiddel placeret mellem det andet segment (3) og en anden plade, der bærer et andet rullesystem.

3. Transportør ifølge mindst ét af kravene 1 til 2, **kendetegnet ved, at** det leddelte armpar (25, 35) kan bevæges på tværs.

4. Transportør ifølge mindst ét af kravene 1 til 2, **kendetegnet ved, at** køretøjets hævning sikres ved interaktion, på hver side af køretøjet, mellem bagarmen (35) med det bagerste af baghjulets slidbaneområde de baghjulet på den ene side, og mellem forarmen med det forreste

af forhjulets slidbaneområde på den anden side.

5. Transportør ifølge mindst ét af kravene 1 til 2, **kendetegnet ved, at** køretøjets hævning sikres ved interaktion, på hver side af køretøjet, mellem bagarmen (35) med det forreste af baghjulets slidbaneområde på den ene side, og mellem forarmen (25) med det bagerste af forhjulets slidbaneområde på den anden side.

6. Transportør ifølge mindst ét af kravene 1 til 2, **kendetegnet ved, at** køretøjets hævning sikres ved interaktion mellem én af armene (25, 35) med én af delene af et hjuls slidbane og en supplerende arm, der kommer i kontakt med en modsat del af samme hjuls slidbane.

7. Automatisk parkeringssystem, der omfatter mindst en transportør ifølge et hvilket som helst af kravene 1-6 til flytning af firhjulede køretøjer, hvilken transportør omfatter et chassis (2, 3), der er forsynet med arme (25, 35), der kan bevæges mellem en position, hvori de muliggør flytning af chassiset (2, 3) under køretøjet, og en position, hvori de kommer i kontakt med hjulenes slidbaner, **kendetegnet ved, at** chassiset (2, 3) er teleskopisk og omfatter to segmenter (2, 3), der hvert bærer et par arme (25, 35), hvor mindst ét af armparrene (25, 35) er leddelt for at muliggøre en flytning mellem en position vinkelret på chassisets længdeakse med en forlængelse, der mindst svarer til køretøjets sporvidde, og en sammenfoldet position for at optage en bredde, der er mindre end afstanden mellem køretøjets indvendige hjulflanker, hvilke segmenter (2, 3) kan bevæges mellem en position, hvor armene (25, 35) ikke er i kontakt med hjulene, og en position, hvor hver arm (25, 35) kommer i kontakt med slidbanen på ét af hjulene, for at sikre hævning og sænkning af køretøjet.

8. Automatisk parkeringssystem ifølge det foregående krav, **kendetegnet ved, at** det omfatter en computer til at styre flytning af transportøren under et køretøjs chassis (2, 3), ved en flytning af transportøren langs køretøjets længdeakse, derefter hævning af køretøjet ved flytning af transportørens segmenter (2, 3) og arme (25, 35), derefter flytning af transportøren til destinationsstedet, derefter frigørelse af køretøjet ved flytning af armene (25, 35) og tilbagetrækning af transportøren ved flytning langs køretøjets længdeakse.

Fig. 1

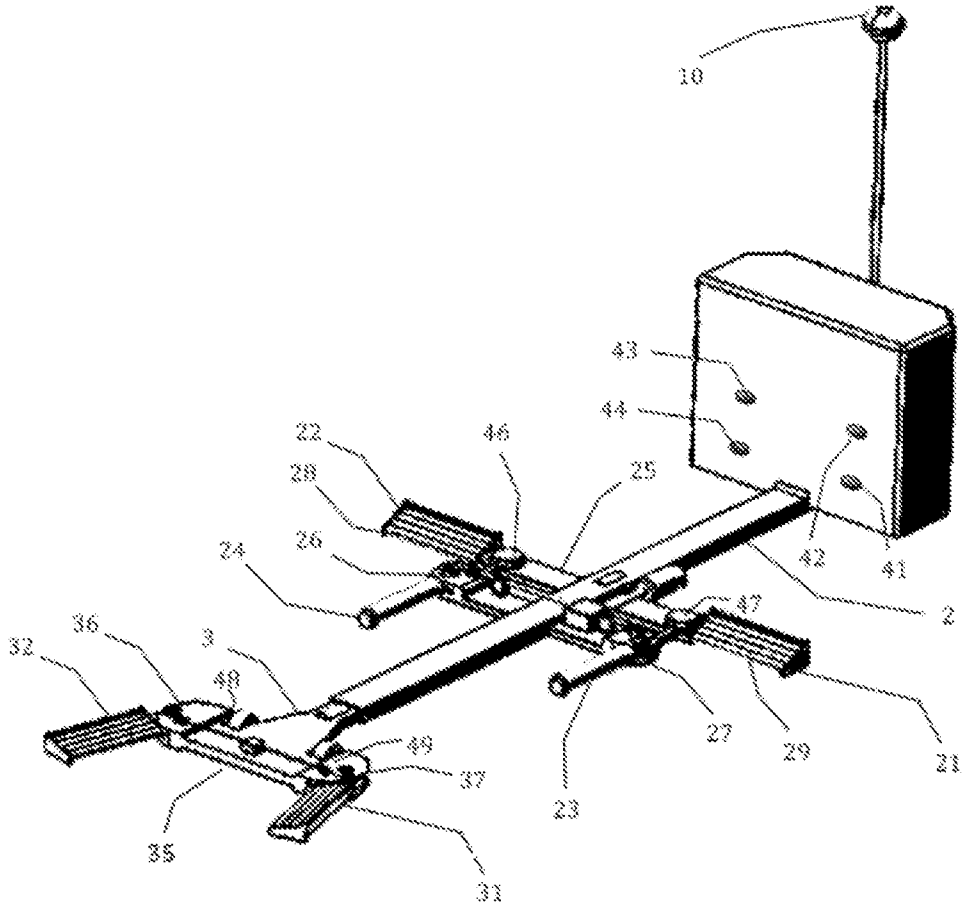
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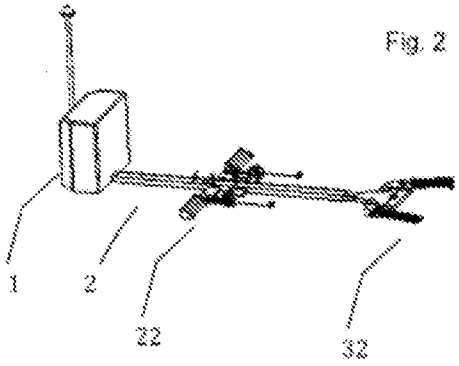
Fig. 2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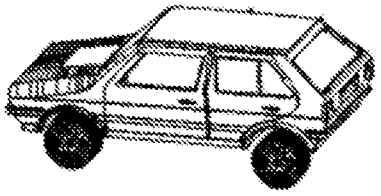

Fig. 3

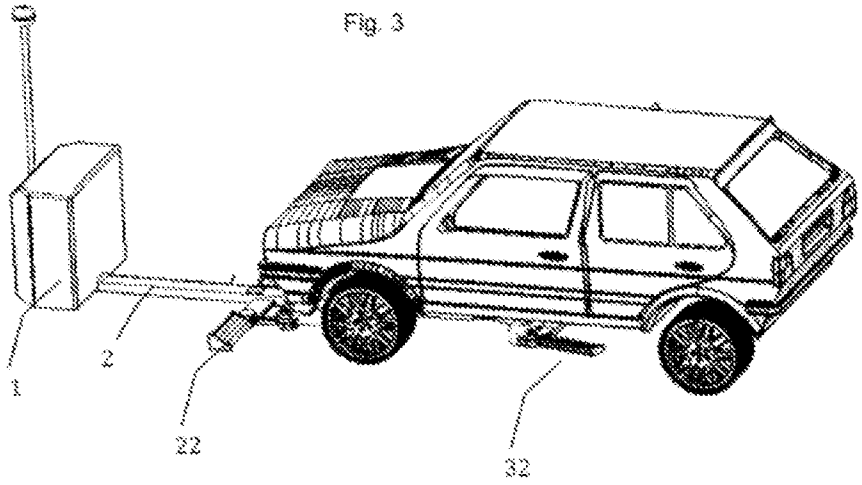

Fig. 4

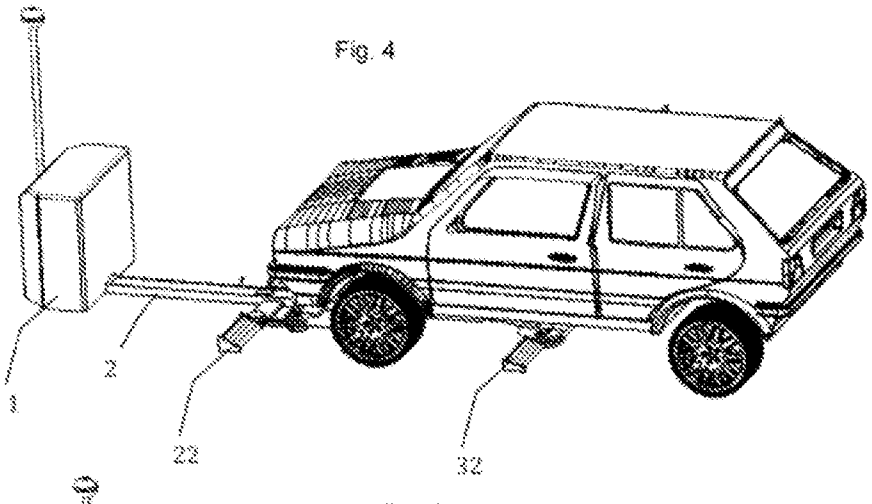

Fig. 5

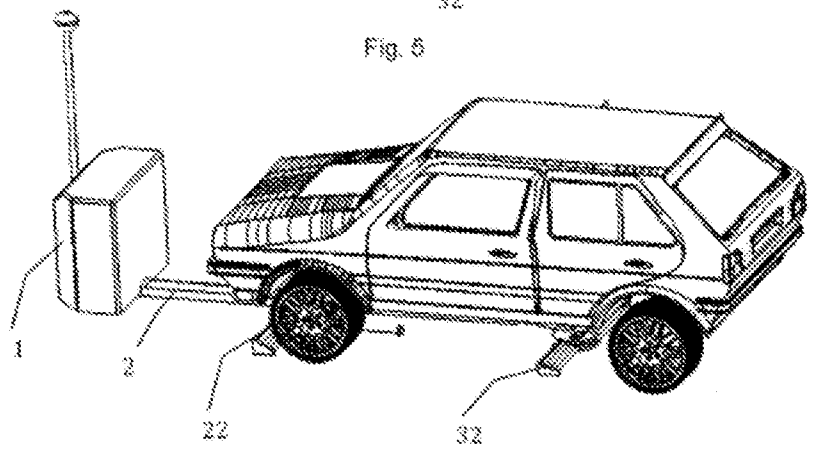

Fig. 6

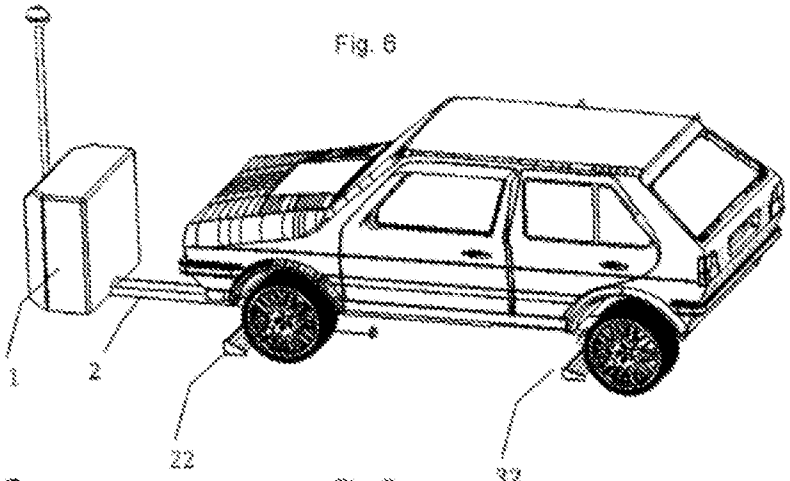

Fig. 7

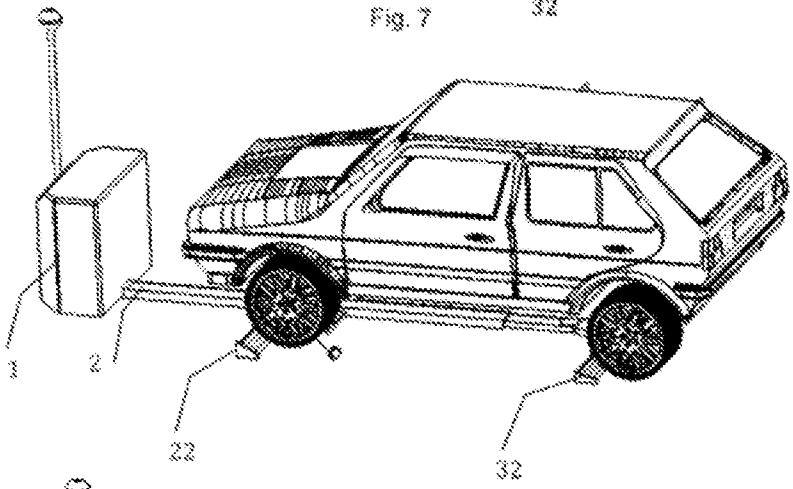

Fig. 8

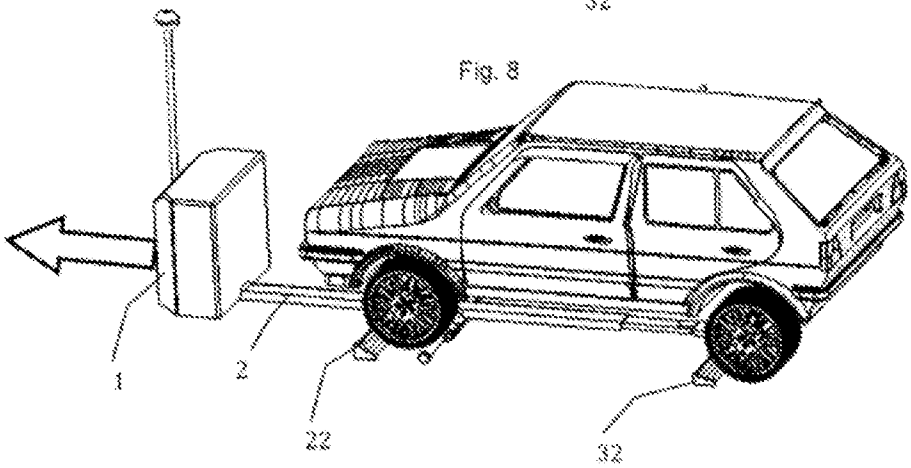

Fig. 9

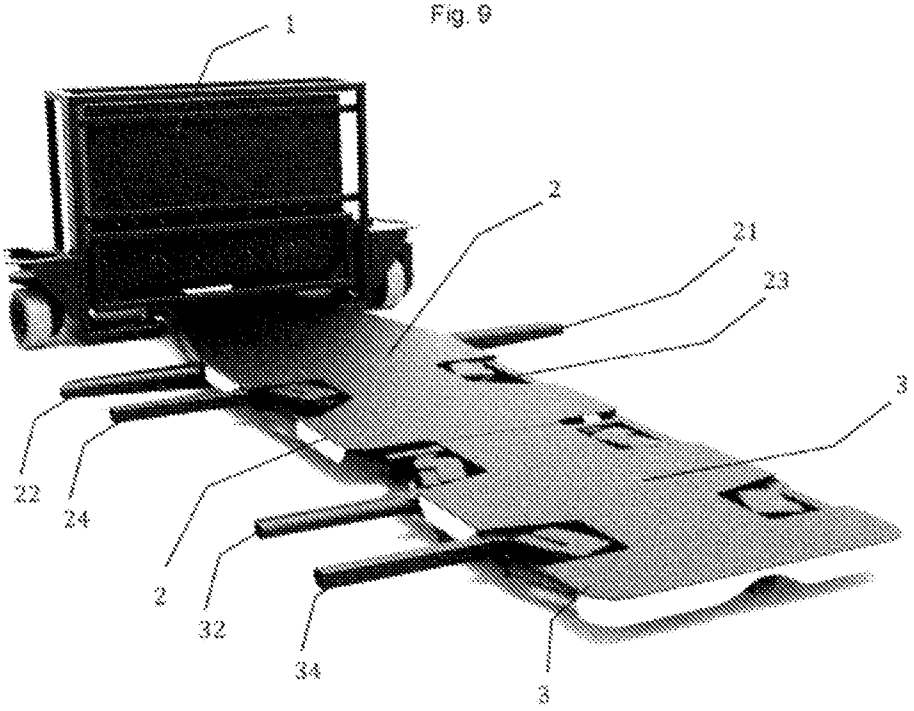

Fig. 10

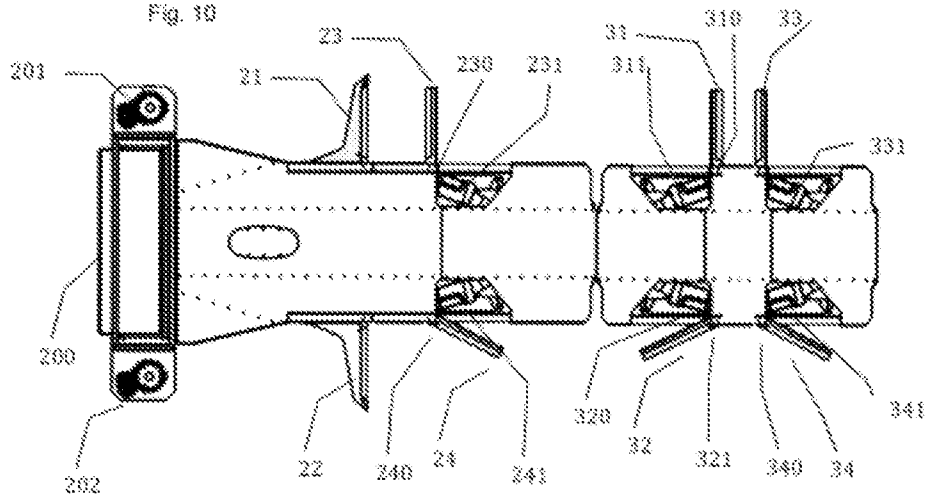
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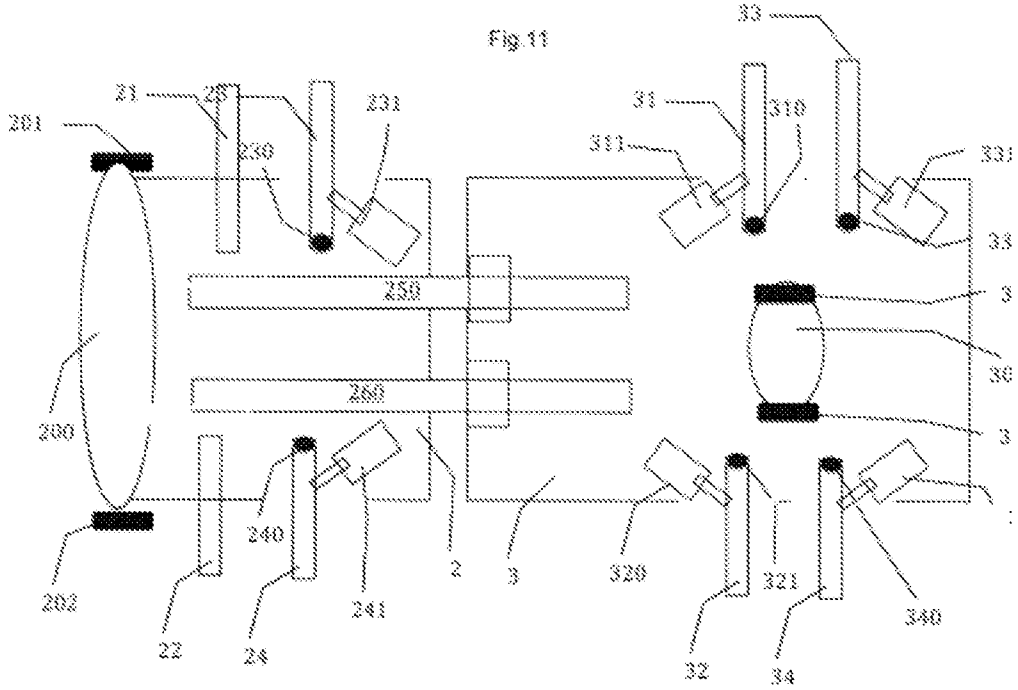
Fig. 11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