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(54) TRAFFIC BARRIER, METHOD FOR USING A BARRIER, AND BARRIER MODULE

VERKEHRSBARRIERE, VERFAHREN ZUR VERWENDUNG EINER BARRIERE UND BARRIEREMODUL

BARRIÈRE DE CIRCULATION, PROCÉDÉ D'UTILISATION D'UNE BARRIÈRE ET MODULE DE BARRIÈRE

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Description

[0001] The invention relates to a for protecting workers and/or equipment from errant vehicles and/or rerouting traffic on a road surface, using a series of connected barrier modules, each barrier module provided with at least one drive. The disclosure further relates to methods for setting up and removing temporary traffic barriers. The disclosure further relates to traffic barrier modules and traffic barriers for protecting workers from errant vehicles and/or for rerouting traffic, in particular to a temporary traffic barrier, and to a barrier module for use in or as such barrier. The invention further relates to a use of a barrier or barrier module(s).

[0002] Traffic barriers are known and are often used on a temporary base, for instance during a period when construction work, such as road works, is to be carried out.

[0003] A known type of traffic barriers which is often used to protect workers from traffic passing by is the so-called Jersey barrier or Jersey wall or Jersey bump. This so-called Jersey barrier is a modular traffic barrier that is arranged to deflect vehicles from crossing to the other lateral side of the traffic barrier. In a transverse cross-section, the outer face of the Jersey barrier defines a lower section having a relatively shallow slope, while an upper section has a relatively steep slope. When a vehicle hits the barrier in a shallow-angle hit, when in top view the angle between the longitudinal direction of the barrier and the direction of travel of the vehicle is thus relatively small, this design can allow the vehicle tires to ride up on the lower shallow sloped face. As a result, the vehicle may be gradually lifted and pivoted away from the area at the opposite lateral side of the barrier. Variations of the Jersey barrier are also known and include for instance the so-called F-Shape barrier, wherein the distance from the ground to the slope break point between the shallow slope and the steep slope is smaller, for instance about 255 mm instead of the about 330 mm often found in a more traditional Jersey barrier. Another variation is formed by the so-called Constant-slope barrier which does not have a shallow slope and a steep slope, but has a side face defining a constant slope of for instance about 10 degrees with respect to the vertical.

[0004] The known Jersey barrier and variations thereof are often made of reinforced concrete.

[0005] However, other materials are used as well. For instance, traffic barriers of plastic barrier modules of the same general shape are also known, and are also called Jersey barriers. Such plastic barrier modules are hollow, and as they are relatively light-weight compared to concrete barrier modules, they may facilitate transport, handling and placement, which may be especially beneficial for short-term applications, for instance in case of road works. The hollow plastic barrier modules may be filled with water, in particular after placement on-site to improve the degree of protection.

[0006] Another alternative material used for barrier modules, such as Jersey type barriers, is metal, in particular steel. Contrary to the plastic barrier modules, the metal barrier modules are not water-filled, but depend on their own weight.

[0007] Also other traffic barriers are known, which may be employed temporarily.

[0008] As mentioned above, a temporary traffic barrier can be used to protect workers or equipment during construction work. The traffic barrier, which for instance may extend over a length of for instance about 100 meters, about 150 meters or several hundreds of meters or more, has to be installed before it can serve its purpose. Usually, the installed temporary traffic barrier will prevent that one or more lanes can be used by the traffic, and/or the traffic barrier may prevent that a shoulder of the road can be used as an emergency stopping lane. This may hinder traffic considerably. Therefore, it is usually desired to keep the length of the temporary traffic barrier relatively short. However, when the construction work, such as for instance paving, shifts along the length of the road the workers will relatively swiftly approach the proximal end of the traffic barrier. Then, additional barrier modules need to be installed to extend the proximal end of the traffic barrier and/or barrier modules near the distal end should be removed. Or from the beginning longer lengths of barrier are installed, which leads to the phenomena that road works are only carried out at a small part of the total demarcated area. Resulting also in more and longer traffic nuisance. Often, this will require that at least one additional lane of the road has to be temporarily closed off, for instance by traffic cones. This will in particular be necessary in case the equipment can not be provided at the other lateral side of the barrier to be placed or to be removed. For instance, in case the barrier is placed on or near an outer edge of a shoulder of the road or near a median of the road, the equipment, for instance including heavy trucks for supplying or removing barrier modules, can usually not use the verge or a median strip.

[0009] Such issues may be even problematic when it concerns a relatively busy road, when there are no suitable detour options, and/or when it concerns a relatively narrow road having relatively few lanes, which for instance may be the case in case of a causeway, for instance a road on top of a dyke. Also other factors may make it more difficult to replace the temporary traffic barrier, such as for instance ecological restrictions which may prohibit nighttime operations. It will be understood that such issues may heavily increase the costs of the barrier operations, for example as it may delay the road work.

[0010] For instance due to such or other issues, installing the temporary traffic barrier is sometimes omitted, which may lead to unsafe situations. Nevertheless sometimes it is prescribed by authorities to omit using temporary barriers at such works, for example when work is expected to take less than two weeks, because placement and removal of the temporary barrier is time con-

suming and costly.

[0011] US2019/0301117A1 discloses a method of using a crash barrier comprising a series of crash barrier sections comprising a deflection body with at least one travelling gear that is movable between a standby position and a displacement position. In the standby position the gear is retracted upward into a receptacle within the deflection body, and is moved out of said receptacle into the displacement position. In the displacement position the crash barrier section can be moved over a road surface. Furthermore the crash barrier section comprises a separate lifting device with which the crash barrier section has to be lifted and supported while the gear is moved from the standby position to the displacement position. This makes this known crash barrier complicated in both design and construction and in use. Moreover it limits the possible ways in how such crash barrier can be used.

[0012] This known barrier is used as a crash barrier, that is used for deflecting or stopping errant vehicles, when the gears are in the stand by position, meaning that the gears are retracted into the deflection body such that the barrier module stands on the lower side of the deflection body. This means that for any movement of a barrier module the barrier has to be lifted first, then be replaced, after which the barrier module has to be lowered again, in order to function as a barrier.

[0013] AU2014265099 discloses a truck with a barrier system comprising modules folding out between a front portion and a back portion of the truck, such that during use the truck with the series of modules forms a temporary barrier.

[0014] WO2017/118475 discloses a crash barrier which is movable using drive units with tracks, which drive units can be rotated around a vertical axis in order to change from a longitudinal movement of the barrier to a movement including an angle with the longitudinal axis. In this known barrier each barrier module comprises at least one such drive unit and a lift unit for lifting the barrier module off the road surface. During use of the barrier as crash barrier, that is while placed for enduring possible impact of traffic, the barrier rests directly on the road surface, with the drive units and lift units retracted upward into the barrier body.

[0015] NL9001524 discloses a barrier with interconnected barrier modules. The barrier modules each comprise at least one drive unit which can be moved up into the barrier body when the barrier is used as a traffic barrier, for impact of vehicles, and can be moved down into an active position for driving the barrier module substantially sideways. The drive units themselves cannot rotate relative to the barrier body. In NL9001524 the movable barrier modules are coupled between traditional stationary barrier modules.

[0016] Again these known barriers are used as traffic barriers, and for any movement of a barrier module the barrier has to be lifted first, then be replaced, after which the barrier module has to be lowered again, in order to function as a barrier.

[0017] It is an object of the disclosure to provide an alternative method for protecting workers and/or equipment from errant vehicles and/or for rerouting traffic on a road surface. More in particular it is an object to provide a method which is simpler in use and providing for improved flexibility in use of a traffic barrier. In particular, it can be an object of the invention to provide a method, wherein at least one of the disadvantages of a prior art method is counteracted. More in particular, the invention may aim to provide a method, wherein at least one of the disadvantages mentioned above is counteracted.

[0018] In an aspect a method of the disclosure can be characterized in that the series of barrier modules is supported on the road surface by their drives only, at least during use as a temporary traffic barrier.

[0019] A barrier module according to the description is used for protecting workers and/or equipment from errant vehicles and/or for rerouting traffic on a road surface while standing on the drives in stead of on the lower side of the body as usual. Since the barrier modules are supported on the drives the modules cq the barrier formed with such modules can move while being used as a barrier. For example the barrier can move alongside moving workers and/or equipment, for example working alongside the road or on a part of the road or above the road. The barrier can move continuously or intermittently, without the necessity of lowering the barrier body onto the road surface in between moves, as in the prior art. With such method the workers and equipment can be well protected by the temporary barrier, which temporary barrier can have a relatively short length. Moreover, since the barrier can move along a surface together with the workers and/or equipment, it is not necessary to time and again set up a barrier, which will reduce hindrance of traffic and reduce cost considerably.

[0020] By supporting the barrier module or modules on their drives only, contact between for example lower edges of the barrier body and the road surface is avoided, preventing damage of the road surface by such edges.

[0021] Barrier modules of the disclosure can be coupled in a substantially longitudinal direction. In embodiments during use the barrier formed by said modules can comprise a bend or curve, which can be maintained during movement of the barrier over said road surface. Thus the barrier can for example be bent or curved around workers and/or equipment, protecting the workers and/or equipment from errant vehicles.

[0022] In embodiments a method of the disclosure can comprise the steps of setting up a traffic barrier comprising a series of interconnected barrier modules, comprising the steps of placing a first barrier module with the at least one drive on a surface, in a first position, moving said first barrier module along said surface to a second position, adjacent the first position and placing a second barrier module on said surface at or near said first position and coupling said second barrier module to said first barrier module. In a similar manner but in reverse order

the barrier modules can also be removed again.

[0023] Moreover the disclosure is directed to a traffic barrier module for protecting workers from errant vehicles and/or for rerouting traffic, suitable for use in a method of the disclosure, wherein the traffic barrier module comprises at least one, preferably at least two drives for moving the barrier module along a road surface, wherein each drive unit comprises at least two sets of wheels or tracks, independently drivable for orienting a driving direction of the drive, and a substantially vertical support for supporting the barrier module on the drive, wherein a lift module is provided for each drive to lift the relevant barrier module relative to said drive.

[0024] Providing a barrier module with at least two drives, each drive having at least two independently drivable sets of wheels and/or tracks, the module can easily and freely be repositioned during use. The independently drivable wheels or tracks of each drive thereby allow the direction of drive of each drive to be set easily by the drive itself, which allows for an easy and robust support construction for supporting the barrier module on the drive. The lift module or modules allow moreover for the height position of the module above the drive to be set.

[0025] Since the traffic barrier includes its own drives, no external drive is needed. The traffic barrier can thus be self-propelled. As a result, the traffic barrier can thus be moved, forward or rearward and sideways, without the need of using any external equipment and/or workers for which otherwise an additional lane would need to have been shut off temporarily during relocating the traffic barrier. This may for instance reduce delay, as the workers do not need to wait until a suitable moment to shut down an additional lane. Moreover this will lead to cost savings and increase safety. Additionally or alternatively, relocating the barrier without needing the external equipment may reduce the exhaust of combustion gasses, in particular when the traffic barrier is propelled by one or more electric motors.

[0026] The invention also provides for a method for relocating an elongate traffic barrier, comprising a first step of providing a modular elongate traffic barrier having multiple barrier modules, said method further comprising a step of moving one or more of the barrier modules of the traffic barrier, in particular substantially in the longitudinal direction of the one or more barrier modules, by means of at least one drive included in said traffic barrier.

[0027] Since the traffic barrier can thus be self-propelled by means of its own drives, moving the traffic barrier, in particular forward or rearward and/or sideways, for instance to relocate the traffic barrier along the road, can be done without using any external equipment and/or workers blocking an additional lane.

[0028] It will be appreciated that the traffic barrier, for example at least when it is in a state in which it is moved forward or rearward at least partly, may be flexible to some extent in its longitudinal direction. This may for instance facilitate that the traffic barrier can follow bends in the road. Thereto, the connections between adjacent barrier modules may for instance be pivotable to a certain extend with respect to each other, for instance at least when at least one of these modules is moved. As a first example, such a pivotable connection can be formed by a pivot. As an alternative example, a flexible connection piece may be mounted between two adjacent barrier modules.

[0029] It will be appreciated that, at least in embodiments, such a pivot and/or such a flexible connection piece may be arranged to be lockable.

[0030] In embodiments, the entire traffic barrier can be integrally driven. As a result, the entire traffic barrier may be moved forward or rearward and/or sideways over a certain desired distance.

[0031] After moving the barrier the barrier modules of the traffic barrier not need be lowered in order to provide for sufficient shielding. Actually, in embodiments the friction between the rolling elements and the road surface and/or when the barrier is relatively long and/or relatively heavy, can be sufficient to counteract that the traffic barrier is substantially displaced upon impact of a vehicle. The temporarily traffic barrier may thus be arranged such that when it is standing on its wheels or tracks it is in a state in which it applies to respective laws, regulations and standards, and for instance meets the EN-1317 crash test standard. In order to provide for a relatively high friction, the rolling elements may for instance comprise continuous tracks or the like.

[0032] In a method according to the disclosure a barrier formed from coupled barrier modules according to the disclosure can move continuously or intermittently at least in a substantially longitudinal direction of the barrier and/or a road surface on which the barrier is used, alongside workers and/or equipment working on and/or above said road surface, also moving at least in said longitudinal direction.

[0033] In embodiments, the traffic barrier can comprise its own power source, which for instance may include at least one battery, internal combustion engine, solar panels and/or electric generator.

[0034] Advantageously, the substantially self-propelled traffic barrier can comprise one or multiple receivers for wired or wireless receiving one or more remote control signals. The traffic barrier may further comprise one or more control units for controlling at least one or more drives and/or actuators of the traffic barrier based at least partly on said one or more remote control signals. This may enable that the traffic barrier can be remotely controlled.

[0035] In embodiments, the traffic barrier may be controlled by a person which is present at the location of the traffic barrier, and which may visually determine whether the traffic barrier moves as desired.

[0036] Alternatively or additionally, the traffic barrier may be arranged to be remotely controlled from a further distance, for instance from a control room or from an office. In embodiments, the self-propelled traffic barrier

may be arranged to propel itself, but may use a remote driver. For instance thereto, the traffic barrier may comprise at least one transmitter for wireless transmitting data about the traffic barrier, such as for instance current location data of the traffic barrier or of a respective part of the traffic barrier, which location data may for instance be based on GPS-data or the like.

[0037] Although such location data may for instance be used for controlling moving of the traffic barrier, the data may additionally or alternatively be used for other purposes. For instance, the data may be shared with one or more service providers, such as for example Flitsmeister, TomTom, Google Maps, etc., which may use the data for instance to inform road users about road works, for instance in order to increase road safety and/or to inform them about expected delay.

[0038] It is noted that the traffic barrier may, alternatively or additionally, be arranged to be used as a self-driving or autonomous traffic barrier. This means that, in embodiments, the traffic barrier can be self-driving, more or less like a self-driving car or so-called autonomous car or so-called robotic car or so-called driverless car. The self-driving traffic barrier may for instance be arranged to be capable of sensing its environment and may be arranged for moving safely, at least relatively safely, with little or no human input.

[0039] For example thereto, the traffic barrier may for instance be provided with sensors and/or other equipment to perceive its surroundings, such as one or more cameras, GPS receivers, radar devices, LiDAR devices, sonar devices and/or odometry sensors, and/or other means which can facilitate self-driving.

[0040] For example, the traffic barrier may be ordered to drive to a certain location or may be set to perform certain tasks. For example, the traffic barrier may be settable to be set to and/or may be substantially directly ordered to drive from a first location to a second location. Such first location may for instance be a location at which the modular traffic barrier is assembled and/or may be a location at which the barrier is temporarily parked, for instance in order to substantially keep the road free at time intervals no road work is performed. Alternatively or additionally, the first location can for instance be a first location where the barrier is used, for instance to protect workers from traffic passing by. The second location can be a location, in particular a further location, where the barrier is used, for instance to protect workers. Additionally or alternatively, the second location may be a location where the barrier is parked and/or dismantled, and may for instance be formed by a parking area along a highway.

[0041] Additionally or alternatively, the traffic barrier may be arranged to and/or set to substantially follow one or more predetermined or specific outside entities, for example one or more pieces of working equipment, such as for instance a paver for laying asphalt concrete or for instance an asphalt cutter. For example, the traffic barrier may be arranged to substantially autonomously and/or substantially cooperatively follow such a working machine or the like, or other entity, along the road when the road works move along said road. Alternatively, the traffic barrier may move along with other work, such as for example roadside work, for instance mowing work. This can be highly advantageous, for instance as this may for example allow that the traffic barrier can be moved without needing to close a traffic lane or additional traffic lane and/or without needing to occupy space for moving equipment for moving the barrier at the lateral side of the barrier at which the road work is to be performed, which for instance may be advantageous in case freshly laid asphalt concrete has not yet cooled down sufficiently. Moreover by using a traffic barrier moving along with road works will require fewer barrier modules, further reducing costs.

[0042] It is noted that the traffic barrier may comprise multiple barrier modules, such as steel Jersey type barrier modules, which may be formed by commercial off-the-shelf barrier modules which then may be adapted by means of one or more of such carriages.

[0043] Although raising and lowering of the barrier module may be done by means of an actuator such as an electric motor, the traffic barrier may alternatively, or additionally, for instance in order to form a back-up functionality, be provided with a lifting and lowering mechanism which can be hand operated.

[0044] Although the present invention is directed to a traffic barrier which can move itself substantially in its longitudinal direction, said traffic barrier may further be arranged for moving at least one of the barrier modules, and preferably at least a section comprising multiple barrier modules, more preferably substantially the entire traffic barrier, in a direction substantially transverse to the longitudinal direction of one or more of the barrier modules.

[0045] Advantageous embodiments according to the invention are described in the appended claims.

[0046] By way of non-limiting examples only, embodiments of the present invention will now be described with reference to the accompanying schematic figures in which:

Fig. 1 shows a schematic perspective view of a causeway provided with a conventional temporary traffic barrier;

Fig. 2 shows a schematic perspective view of an embodiment of a traffic barrier according to an aspect of the invention;

Fig. 3 shows a schematic partly cut-away side view of another embodiment of a traffic barrier according to an aspect of the invention;

Fig. 4 shows a schematic perspective view of an embodiment of a traffic barrier according to a further aspect of the invention;

Fig. 5 shows in longitudinal cross sectional side view of a barrier module of the disclosure;

Fig. 6 shows a cross sectional view of a barrier module along the line VI - VI in fig. 5;

Fig. 7 shows partly broken away a barrier module according to the disclosure, with two drives;
Fig. 7A shows partly broken away part of a module according to the disclosure, in top view;
Fig. 8A - D show four steps of coupling of two barrier modules of the disclosure;
Fig. 9 shows in perspective view an embodiment of a drive according to the disclosure;
Fig. 10 shows in perspective view a drive according to claim 9, provided with a lift module;
Fig. 11 shows a drive with part of a barrier module partly broken away;
Fig. 12 shows in perspective view a drive with part of a vertical support;
Fig. 13A - C show different height positions of a housing relative to the drive, for adjusting the height position of a barrier module;
Fig. 14 shows a horizontal cross sectional view of a drive, taken along the plane XIV - XIV in fig. 12;
Fig. 14A shows in top view schematically a drive with wheels;
Fig. 14B shows in top view schematically a drive with holonomic wheels;
Fig. 15A - I show steps in a method of setting up a barrier of the disclosure, which in reverse order can also be understood as a method for removing a barrier; and
Fig. 16 shows in top view part of a road with a parking bay, with a barrier placed on the parking bay, to be moved onto the road.

[0047] In the drawings embodiments are shown of barrier modules and barriers provided with such barrier modules, as well as methods for using movable barriers and barrier modules. These embodiments are only shown by way of example and are not limiting the disclosure in any way or form. In the figures, the same or similar reference signs or numbers refer to equal or corresponding parts.

[0048] In this application road surface has to be understood as any surface on which a barrier or barrier module as disclosed can be used, including but not limited to surfaces made of hard materials such as asphalt, tarmac, concrete, cobbles, brick, stone, cement or the like, metal or concrete or the like driving plates, or soft materials such as sand or gravel, and may be any surface on which vehicles can pass, such as roads, carparks, petrol stations, utility areas, storage facilities and the like.

[0049] In this disclosure words like substantially should be understood as meaning that slight variations on a value it refers to are also considered as being comprised by such value, such as for example variations of 20% or less, such as for example 15% or less, for example 10% or less, for example 5% or less, unless otherwise indicated or clear from the context of the wording.

[0050] Figure 1 shows two conventional temporary traffic barriers 101. Here, the temporary traffic barriers 101 are temporary placed on the shoulders 120 of a road 121 on top of a dyke 122. In this case, the temporary traffic barriers 101 are installed to protect workers 123 from errant vehicles as the standard guiderails 124 have been removed locally in view of construction work to the dyke. For instance during installing, dismantling or relocating the temporary traffic barriers 101, not only the emergency lane formed by the shoulder 120 is blocked by the temporary traffic barriers 101, but also an additional lane 125 of the road 121 is blocked by equipment 126 used for relocating modules 102 of the temporary traffic barrier 101.

[0051] Figure 2 shows a schematic perspective view of a first embodiment of a traffic barrier 1 according to an aspect of the invention, which is formed as a self moving traffic barrier 1. The traffic barrier 1 is arranged and/or intended for protecting workers from errant vehicles and/or for rerouting traffic. The traffic barrier 1 forms a temporary traffic barrier, in particular a crash rated movable highway barrier.

[0052] In embodiments of the present invention, such as in the embodiment shown here in Figure 2, the traffic barrier may be shaped as a so-called Jersey barrier or Jersey wall or Jersey bump, or a variation thereof, such as for instance a so-called F-Shape barrier or a so-called Constant-slope barrier.

[0053] In a transverse cross-section, the outer face of the barrier 1 can for instance define a lower section 11 having a relatively shallow slope 12, while an upper section 13 has a relatively steep slope 14. The relatively shallow slope 12 may for instance make an angle of about 45° - 65° with the horizontal plane, preferably an angle of about 50° - 60°, such as about 55°. The relatively steep slope 14 may for instance make an angle of about 75° - 90° with the horizontal plane, preferably an angle of about 80° - 88 °, such as about 84°.

[0054] The traffic barrier 1 comprises multiple elongate barrier modules 2 which are connected to each other, preferably in a manner wherein two adjacent barrier modules can pivot with respect to each other to a certain amount, at least when the self moving traffic barrier 1 is being relocated or shifted from one location to another location. In the embodiment of Figure 2, the barrier modules 2 are connected to each other via an intermediate barrier part 3, which here is formed by a carriage 9. However, in alternative embodiments, such as for instance the embodiments shown in Figure 3 and Figure 5, the barrier modules 2 are connected directly to each other.

[0055] Here in the embodiment shown in Figure 2, the barrier modules 2 are made of metal, in particular steel. However, the barrier modules 2 may be made of any other suitable material or materials, such as for instance reinforced concrete or plastic.

[0056] The height of the barrier modules 2 may correspond with the height of a conventional barrier module 2 of a conventional temporary traffic barrier, and/or may for instance be at least about 50 cm, preferably being at least 65 cm, more preferably at least 80 cm, such as about 85

cm, about 90 cm, about 100 cm, or even more, such as for instance about 105 cm or about 115 cm.

[0057] The width of the barrier modules 2 may correspond with the height of a conventional barrier module 2 of a conventional temporary traffic barrier, and/or may for instance be at least about 45 cm, preferably being at least 50 cm, more preferably at least 55 cm, such as about 60 cm, for instance 58 cm or 61 cm, or even more, such as for instance about 80 cm or for instance 82 cm.

[0058] According to an aspect of the invention, the traffic barrier 1 comprises at least one drive 5 for moving at least one of the barrier modules 2 substantially in the longitudinal direction D1, D2 of the barrier module 2. The drive may for instance comprise an actuator 6 for moving the at least one of the barrier modules 2. For example, the actuator 6 may be an electric motor 6, but may alternatively be another type of actuator 6.

[0059] For example in fig. 9 - 11 and fig. 13 and 14 embodiments of a drive 5 and parts thereof for use in or with a barrier module 2 are shown, in different views.

[0060] In embodiments, the actuator 6 may drive one or more wheels 7 or other rolling elements 7, such as for instance cylindrical rollers or balls or continuous tracks, in order to move the respective barrier module 2 or modules 2, or even the entire modular traffic barrier 1 substantially in its respective longitudinal direction D2, D1, and preferably also in any other direction including an angle with said longitudinal direction, substantially parallel to a surface on which the drive 5 is supported. As such, the traffic barrier 1, or at least one or more parts or sections thereof, may be shifted, for instance to be adjusted to follow the road works that may also shift or move on along the longitudinal direction of a road.

[0061] The drives 5 can comprise two sets of wheels or tracks 7 which can be independently driven by the actuator 6 or separate actuators 6, such as for example one or more hydraulic or electric motors. In for example fig. 8 - 14 the drives 5 are shown provided with two tracks 7, as will be further discussed. Alternatively, as shown schematically in fig. 14A the drive 5 can be provided with two sets of wheels 7, for example two on each side of the carrier 53, of which at least one on each side is a driven wheel 7, for example driven by a motor 61 and gear 61, similar to the drive as shown in fig. 14.

[0062] In an alternative embodiment as shown schematically in top view in fig. 14B the drive 5 can be or comprise an holonomic wheel, omni wheel, or Mecanum wheel based drive 5. In such drive 5 each wheel 7 is provided with a series of rollers 7A provided at or forming the circumference of the wheel 7, which rollers 7A each have a rotational axis at an angle relative to the axis of the wheel 7, such that each wheel can move over a surface in all directions, as is known in the art. In such embodiment each wheel 7 is in fact a set of wheels. The wheels 7 are all driven by a motor 60 through a gear 61, such that they can be driven independently from each other, for changing drive directions D_5 of the drive 5. Such drive 5 can for example have three or more wheels 7. Obviously different types of these drives 5 can be combined in a barrier module 2 or barrier 1. With such drive 5 the drive 5 can move in any horizontal direction, without the necessity of rotating the carrier 53 of the drive 5.

[0063] In further alternative embodiments a drive 5 of a barrier 1 or barrier module 2 for use in a method according to the disclosure can be provided with a support 40, especially a substantially vertical support, with a rotator connected to or cooperating with the support 40 for rotating the support 40 or part thereof together with the drive 5 for changing the driving direction D_5 of the drive 5 and thus changing a direction of movement of the barrier 1 or barrier module 2.

[0064] The traffic barrier 1 may comprise carriages 9, that are arranged for moving at least one of the barrier modules 2, as for instance can be seen in the exemplary embodiment of Figure 3. The carriage 9 may be formed as a built-in unit 8, which for instance may be built into a more or less standard barrier module, for instance a commercial off-the-shelf barrier module. Such carriage 9 can comprise a drive 5 as disclosed.

[0065] The barrier 1 or barrier module 2 may comprise a battery 10, or other power source, which for instance may feed the actuator 6 of said drive 5. However, the power source may alternatively be located outside of the module 2.

[0066] Additionally, the traffic barrier 1 may be provided with one or more solar panels 33, which for instance may be used for recharging one or more batteries 10 of the traffic barrier. Preferably, the solar panels 33 can be removable installed on a barrier module 2, for example after installing the traffic barrier 1 on its initial position. In embodiments, the solar panels 33 may be arranged such that they can form a fence 135 on top of the traffic barrier 1, for example hiding the construction work from view at least partly, thereby for instance counteracting that road users may be distracted by said construction work. These could also be different panels 135, preferably non-transparent panels.

[0067] For instance in order to mount such solar panels 33, or in order to mount other elements, such as reflector elements, the barrier modules 2 may be provided with connectors 34, for instance formed by one or more receiving channels 34 or other apertures 34 or the like, which may be provided for instance at a top end of the barrier module 2. The rolling elements 7 can be driven by the drive 5.

[0068] The traffic barrier 1 can comprise a receiver 16 for wireless receiving one or more remote control signals. The traffic barrier 1 may then further comprise at least one control unit 17 for controlling at least one or more drives 5, 19 and/or actuators of the traffic barrier based at least partly on said one or more remote control signals.

[0069] Additionally or alternatively, the traffic barrier 1 may comprise at least one transmitter 18 for wireless transmitting data about the traffic barrier 1, such as for instance current location data of the traffic barrier 1 or of a respective part of the traffic barrier 1, which location data

may for instance be based on GPS-data or the like. In embodiments, the transmitter 18 may be integrated with the receiver 16 and/or with the control unit 17. Fig. 3 shows a camera 105 with which for example images can be taken of one or more barrier modules 2, in order to assess their positions relative to each other and/or their position relative to a road, objects, workers and the like.

[0070] It will be appreciated that the control unit 17, the receiver 16, and/or the transmitter 18, two or more of which may be integrated with each other, can be provided in a barrier module 2, an intermediate barrier part 3 and/or a drive 5 or other built-in element.

[0071] Although the traffic barrier 1 and/or one or more of the barrier modules 2 and/or other barrier parts may be arranged to be remotely controlled in a wireless manner, the traffic barrier 1 and/or one or more of the barrier modules 2 and/or other barrier parts may, alternatively or additionally, be arranged to be remotely controlled in a wired manner. One, multiple or each barrier module 2 and/or other barrier part and/or the traffic barrier 1 may be provided with a wired remote control, which can be removably connectable thereto. The remote control may for instance be hand-held by a person, for instance a person walking along with the moving barrier 1. However, other embodiments are possible as well. For example, the remote control may be part of and/or attached to a piece of working equipment, such as a mower, paver, asphalt cutter, etc., which may move along the road during the work. Additionally or alternatively the barrier modules 2 or barrier 1 or the remote control 100 can comprise software for defining a route for the barrier modules 2 and/or barrier to follow.

[0072] Further, it will be appreciated by the skilled person that a control unit 17 or so-called controller may be used to control multiple drives and/or actuators, for instance also drives and/or actuators located in other barrier parts, e.g. in other carriages and/or in other barrier modules than the one in which said control unit or controller 17 is provided. For example, the barrier may then comprise a main control unit 17 which, in particular based at least partly on remote control input data, may control locally provided secondary control units 17 that may locally control one or more drives or actuators, for instance at the barrier part where such secondary control unit 17 is provided.

[0073] In embodiments, as is for instance the case in the embodiment of Figure 3, the rolling elements 7 can be moved between a retracted position, in which they are lifted with respect to the respective barrier module 2 and/or with respect to the underlying road surface 35, and an extended position, in which the rolling element 7 engages said road surface 35. Thereto, a lift 19 for moving the rolling elements 7 from their extended position to their retracted position, and vice versa, may be provided, which lift 19 may comprise an actuator, for instance an electric motor, which for instance may be fed from the same power source 10 as the drive 5 for driving the one or more rolling elements 7. In embodiments, the drive 5 for driving the one or more rolling elements 7 and the drive 19 for extending and retracting the one or more rolling elements 7 may be formed by a single drive and/or may share the same actuator.

[0074] Although the extending and retracting of the rolling elements 7 can preferably be done automatically, i.e. by means of an actuator, the traffic barrier 1 may alternatively, or additionally, for instance in order to form a back-up functionality, be provided with a lifting and lowering mechanism which can be hand operated. Thereto, as can be seen in Figure 3, the drive 19 for retracting and extending the rolling elements 7 may be arranged to be hand operated, for instance by means of a control handle that can be removably attached via a connector 29.

[0075] Preferably the drives 5 is only retracted into the module 2 for storage of the module, for example on a transport vehicle 106, but is extended during use of the module 2 as or in a barrier 1. It will be appreciated that not each one of the drives 5 will need to be actively driven in order to propel the barrier 1 or the barrier module 2, as some of the rolling elements may be idle in some embodiments.

[0076] In embodiments, such as for instance in the embodiment of Figure 2, the carriage can be mounted to a distal end of a body of a first one of the barrier modules 2 and is also mounted to a proximal end of a body of a second one of the barrier modules 2 being adjacent to said first one, thereby forming a connecting piece between said two adjacent barrier modules 2. Advantageously, the carriage may be designed such that the outer lateral surfaces 42, 44 thereof may be substantially flush with the corresponding outer lateral surfaces 22, 24 of the two adjacent barrier module bodies.

[0077] It will be appreciated that respective parts 2, 3 of the traffic barrier 1 may be arranged to be connected to each other to assemble an elongate traffic barrier 1. Thereto, respective elements or parts of the barrier 1, such as the barrier modules 2 and/or intermediate barrier part 3, if any, may be provided with connectors 15.

[0078] Fig. 5 schematically shows a side view of a traffic barrier module 2 for forming a barrier 1 for protecting workers from errant vehicles and/or for rerouting traffic, with an outer wall 2A of the barrier module 2 partly broken away. Fig. 6 shows such module 2 in a cross sectional view along the line VI - VI in fig. 5. The traffic barrier module 2 can have a shape similar to for example as shown in fig. 2, wherein a barrier module body 2C can comprise the lower section 11 and upper section 13. The barrier module 2, especially the module body 2C will have a lower longitudinal edge 41 which is here shown as the outermost side edge 41 of the module 2 too.

[0079] The traffic barrier module comprises at least two drives or drive units 5, also referred to as carriages 9, for moving the barrier module along a road surface 35, 127. Each drive unit 5 comprises at least two sets of wheels or tracks 7, independently drivable for orienting a driving direction D_5 of the drive 5. A general driving direction D_5 of a drive unit 5 will be straight forward or backward if the

sets of wheels or tracks are driven at the same speed, whereas the general driving direction will be curved if the sets of wheels or tracks 7 are driven at different speeds. Unless defined differently a driving direction D_5 of a drive has to be understood as a direction in which a drive unit 5 will or would move if the sets of wheels or tracks 7 are or would be driven at the same speed. A vertical support 40 is provided for supporting the barrier module 2 or at least the body 2C of the barrier module 2 on the drive 5. The support 40 preferably extends substantially vertical. A lift module 43 is provided for each drive 5 to lift the relevant barrier module 2 or at least the body 2C relative to said drive 5.

[0080] The barrier module 2 comprises a housing 44 for the substantially vertical support 40, allowing rotation of the support 40 around a longitudinal axis X_{40} of the support 40. Moreover the housing 44 allows movement of the housing 44 in the longitudinal direction L_{40} of the support 40. Preferably to this end the lift module 43 is connected to the housing 44. The housing 44 can be connected to the wall 2A of the barrier module 2. A housing 44 can be of open or closed construction and provides for a connection between the barrier body 2C and the drive 5 or at least a support 40 thereof.

[0081] In the embodiment as shown, by way of example, in fig. 5 and further elucidated for example in fig. 8 - 11 and 13, the lift module 43 engages a base frame 46 around the support 40. In this embodiment the lift module 43 comprises an arm 47, pivoting around a pivot axis 48, which here is shown extending substantially horizontally. One end 49 of the arm 47 is connected to a motor 50 and a second end 51 of the arm 47 engages the support 40. The motor 50 preferably is a linear motor, such as an electric motor, with which at least a pulling force F_p can be exerted on the said end 49 of the arm.

[0082] The support 40 comprises a lower part 52, which is connected to the drive 5 or at least to a base part 53 of the drive 5, and an upper part 54 rotating in the housing 44. The upper part 54 extends into the housing 44, such that a telescoping support 40 is provided. The housing 44 can rotate around the shaft comprising the lower part 52 and the upper part 54, around the longitudinal axis X_{40}, preferably over at least an angle of 180 degrees. The second end 51 of the arm 47 rests on an upper end 55 of the lower part 52, such that when the motor 50 pulls at the first end 49 of the arm 47, the arm 47 will pivot around the pivot axis 48 and push the barrier module 2, or at least the housing 44 with the barrier module body 2C connected thereto upward relative to the base part 53 of the drive 5. Allowing the arm 47 to pivot in the opposite direction will lower the barrier module 2 again due to at least gravity.

[0083] The upper part 54 of the support 40 extends into the housing 44 and the base frame 46 of the support 40, wherein bearings are provided for allowing the rotation of the drive, at least the base part 53 relative to the barrier. The housing 44 has an upper end 74 which is fixed in the housing 44, such that it cannot move, especially not up or down. The lower part 52 has an upper end 55 which forms a flange. The arm 47 can have an end extending on two opposite sides of the upper part 54, engaging said upper end 55, ensuring an even better distribution of forces. The upper part 54 is preferably supported in a bearing pot 74A such that the upper end 54 can rotate within said pot 74A.

[0084] In the embodiments shown and discussed, and as indicated for example in fig. 7 - 14 each drive 5 is provided with a drive body 53 and a left side drive 56 and a right side drive 57. The left side drive 56 and right side drive 57 are positioned at opposite sides of an imaginary vertical center plane V, preferably a plane extending through the vertical axis X_{40} of the support 40. Each of the left side drive 56 and right side drive 57 comprises a drive wheel 58A, B and a driven or idling wheel 59A, B, and a track 7 extending around the relevant drive wheel 58A, B and driven wheel 59A, B. Each drive wheel 58 A, B is connected to a motor such as an electric motor 61 through a gearing 62. The gearing 62 is preferably a reducing gearing, reducing the rotational speed of the drive wheel 58 relative to the axis of the motor 61 significantly, for example at a ratio of 20:1 or more, such as for example 40: 1, preferably at least 50:1, such as for example 100:1. Each side drive 56, 57 is furthermore provided with a track tensioner 67, for tensioning the track 7 around the wheels 58, 59. Moreover one or more guide rollers 68 can be provided between the wheels 58, 59 for supporting the track 60 further.

[0085] The design of the drives 5, such as the gearing ratio, is preferably chosen such that the track 7 will not rotate the drive wheel 58 when the barrier module 2 is pushed near the relevant drive in a substantially horizontal direction, for example upon impact of a vehicle on the barrier module 2 in line with test protocols of NEN-EN-1317. The barrier will not roll away upon such impact and will perform in accordance with NEN-EN-1317 as a temporary traffic barrier, even when the traffic barrier 2 is supported on the road surface 35, 127 by the drives 5 only. This means that the lower edge 41 will be suspended above the road surface 35, 127 and the barrier module 2 cq barrier 1 can be moved over said road surface immediately by driving the motors 61. The height H of the barrier module body 2C can be adjusted using the lift mechanism but this is not necessary since the barrier 2 will rest on the surface by said drives 5.

[0086] In a similar manner a drive unit as shown in fig. 14A, having wheels 7 without tracks, or in fig. 14B, comprising omni directional wheels, can be designed to allow use of the barrier module 2 provided therewith, or at least a barrier provided with such modules, to be used as a barrier, conform said test protocols line NEN-EN-1317, without the lower edge or support elements of the barrier, other than the drives, having to be resting on the road. According to the invention as defined in claim 14, the drives are self-braking

[0087] In all embodiments it can be achieved to allow use as the barrier when supported on the drives 5 only, be it with tracks, wheels, omni direction wheels or combina-

tions thereof, in various ways, examples of which will be discussed, without limiting the disclosure.

[0088] As discussed, a gearing 61, especially a low gearing 61 can be provided between a motor 60 and a wheel 7, ensuring that the wheel 7 can be actively rotated by the motor 60 but which will make it very hard or even impossible to rotate the wheel by pushing against the barrier module 2, especially by impact of a vehicle. Alternatively a direct driven track or wheel could be used, using a low revolution motor or low rev motor. For example a low RPM, high torque motor can be used. In embodiments the motor or motors can be a hydro-motor. A low revolution motor is known in the art and can in the present disclosure be used as a self-braking motor. An example of such hydro-motor is a Hägglunds motor, which inter alia allows a compact design of the drive units 5. In addition to or alternative to a gearing and/or a low rev motor a brake 200 can be used in or for each drive or drive unit. A brake 200 can for example be an electrical brake or a mechanical brake. In embodiments a drive 5 can be braked by using an electrical current applied to the engine or motor 61.

[0089] A brake 200 for use in a barrier 1 or barrier module 2 according to the disclosure can be a negative brake. In such brake the drive 5 is braked when the brake 200 is not powered, such as in a rest position. In order to be able to drive the drive units 5 in such embodiment the brake 200 has to be powered, for example by an electrical current or mechanically, in order to release the brake 200 and allow the motor 61 to drive the relevant wheel 7 or wheels 7 or track 7.

[0090] A brake 200 for use in a barrier 1 or barrier module 2 according to the disclosure can be a positive brake. In such brake 200 the drive 5 is braked when the brake 200 is powered. In order to be able to drive the drive units 5 in such embodiment the brake 200 is released, whereas for braking the brake 200 is powered, for example by an electrical current or mechanically, in order to engage the brake 200 and prevent the motor 61 to drive the relevant wheel 7 or wheels 7 or track 7.

[0091] Alternatively or additionally a barrier 1 or barrier module 2 can be provided with a brake system comprising one or more elements 201 that can be dropped onto a surface 35 on which the barrier 1 is used, for increasing friction, substantially preventing the barrier 1 or barrier module 2 from moving along said surface 35. Such element 201 can for example be a block, such as but not limited to a rubber or concrete block, providing such friction for example by weight of the element 201 and/or by being pushed against the surface, for example by (electro)mechanical means 202.

[0092] In such brake systems as described here before by way of example preferably at least a sensor system 203 is provided, comprising a sensor 204 during use sensing impact of a vehicle on the barrier 1 or barrier module 2. If such impact is sensed the sensor system 203 will activate the brake or brakes or brake system of the barrier 1 or barrier module 2, such that movement of the relevant barrier 1 or barrier module 2 is substantially prevented, ensuring the proper use as an impact barrier. Such sensor system 203 is for example known from airbag systems used in cars, motor cycle or bike helmets and the like.

[0093] Additionally or alternatively to a sensor system 203 sensing impact of a vehicle a sensing system can be used detecting proximity of a vehicle to the barrier 1 or barrier module 2. In such system a threshold value can for example be set for an allowable proximity of a vehicle to the barrier 1 or barrier module 2 and/or for an allowable relative speed and/or direction of speed of such vehicle to said barrier 1 or barrier module 2. If a vehicle comes closer to said barrier 1 or barrier module 2 below said threshold value and/or has a speed and/or direction of speed relative to the barrier 1 or barrier module 2 the sensor system 203 can activate one or more brake 200 or brake system in order to proactively preventing the barrier or barrier module from movement should impact of said vehicle follow. In such embodiments preferably the sensor system will be set such that if no impact follows said detection within a predetermined time interval thereafter, the brake(s) or bake system will be released again, allowing the barrier 1 and/or barrier module 2 to move again. Such sensor system can for example comprise one or more known proximity sensors, such as but not limited to optical sensors, electro-mechanical sensors, radar, (untra)soon sensors and the like. Such sensors are for example known from use in cars, lorries and trucks, machines and the like.

[0094] Alternatively or additionally the barrier 1 or barrier module 2, especially the drive units 5 can be designed such that upon an impact on the barrier 1 or barrier module 2, or in embodiments upon detection of a vehicle within a predetermined distance of the barrier 1 or barrier module, or having a speed or direction of speed relative to the barrier or barrier module above a set threshold value, the barrier 1 or barrier module 2 will drop such that a lower side 41A of the barrier 1 or barrier module 2, especially support elements thereof, such as for example but not limited to lower edges 41, support feet or the like, will support the barrier 1 or barrier module 2 on the surface 35 on which the barrier 1 or barrier module 2 is placed instead of or next to the drive units 5, increasing friction between the module 2 or barrier 1 and said surface 35. Again this can be triggered by a sensor system 203, such as known from air bag systems as described here above, or for detecting proximity and/or relative speed and/or direction of speed of a vehicle, as described here above.

[0095] It should be noted that brakes 200 and brake systems as described can be used for any type of drive, including wheels, tracks and omnidirectional wheels as disclosed herein.

[0096] In general the drive units 5 are self-breaking, for example by use of an appropriate type of motor 61, gearing 62 and/or drive wheels or tracks 7, and/or can be provided with brakes or a braking system, including a sensor system for engaging the braking system upon

impact of a vehicle on the barrier or barrier module or upon detecting proximity and/or relative speed and/or direction of speed of a vehicle, as described here above.

[0097] Fig. 14 shows a horizontal cross sectional view of a drive 5 through the drive wheels 58 and driven wheels 59 at the level of the motors 61 and gears 62. As can be seen in fig. 14 the motors, preferably electric motors 61, can each be positioned substantially between a drive wheel 58 to which it is connected and a driven wheel 59 of the opposite side drive 56, 57. Each motor 61 is connected to the drive wheel 58 through a gearing 62. As can be seen the gearing 62 can extend in an axel stump 62A, whereas the drive wheel 58 is mounted over an outside of said stump 62A using two side by side, spaced apart bearings 69. A lid 70 is mounted on an outgoing axis 71 of the gearing 62, and is connected to a side of the drive wheel 58, for example by one or more bolts or pins 80 or the like. The bearings 69 bear most of the forces exerted on the wheel 58 and track 60, such that the gearing 62 substantially only has to provide the driving force for the drive wheel 58.

[0098] The substantially vertical support 40 is preferably fixedly connected to the base part 53 of the drive, between the left side drive 56 and the right side drive 57, central between the wheels 58, 59. Thus the base part 53 with the tracks 7 can rotate the drive 5 easily relative to the barrier module 2 around the axis X_{40}, substantially without drag of the tracks 7 over the surface.

[0099] As can be seen in fig. 14 the shape of the base part 53 with the wheels 58, 59 can be substantially square. The size of the base part 53 with the wheels 58, 59 is preferably such that in any rotational position thereof the base part stays, in top view of the barrier module 2, substantially between the opposite longitudinal side edges 41. In other words, the tracks preferably do not extend sideways passed said longitudinal side edges or at least do not extend beyond a maximum width of the barrier module 2, measure perpendicular to the longitudinal direction D1, 2 of the barrier module 2. Preferably the drives do not extend in horizontal direction passed a two parallel vertical planes V1, V2 extending through the most outward longitudinal side edge of the barrier module 2, in the embodiment shown in fig. 6 the lower edge 41. Thus during normal use of the barrier 1 or barrier module 2, when standing on a road surface 35 by the drives 5, a vehicle cannot come into contact with the drive 5, irrespective of the rotational position of the drive 5. Thus further enabling use of the barrier 1 and barrier modules 2 as a barrier when supported by the drives 5 only.

[0100] A barrier 1 formed with barrier modules 2 as described can be driven over a road surface 35 using the drives 5. Since the individual drives can be rotated around their respective vertical axis X_{40}, the modules 2 and hence the barrier 1 can be driven in any direction and configuration, such as straight, bent, curved or hooked. Various modules 2 can be driven relative to other modules 2 in order to change their relative positions, especially angles α relative to each other, which can for example be defined as an angle α between their longitudinal direction D, as for example shown in top view in fig. 16. The barrier modules are preferably coupled to each other by couplings 15 allowing some pivoting around a vertical axis, but preferably little longitudinal movement of one barrier module 2 relative to an adjacent module 2 coupled thereto. However alternatively modules 2 can be driven and/or used individually or as sets. In order to enable accurate positioning and driving of the modules 2 or the barrier 1 different sensors can be provided, connected to the control unit 17. In embodiments sensors can be used which can communicate with the control unit 17 and/or each other via a wireless connection. In the embodiments shown the sensors can be connected through wired connections, schematically indicated by an elastic electronic connection W between two modules 2 in fig. 15. They can also thus be connected to the control unit or units 17 and/or to a remote control 100, by wire or wireless.

[0101] For example in embodiments a direction sensor 81 can be provided for sensing a drive direction D_5 of a drive 5, especially a drive direction D_5 of the drive relative to a longitudinal direction D of the module 2. Preferably a direction sensor 81 is provided for each drive 5 of the module 2. In the embodiments shown such direction sensor 81 can for example be provided in the housing 44 above the vertical support 40 and can for example sense said driving direction D_5 through the upper part 54 of the support 40. The direction sensor 81 can for example comprise a rotation encoder mounted to the support 40. The vertical axis or shaft comprising the upper and lower parts 54, 52 and connected to the carrier 53 of the drive 5 can be considered one unit part, whereas the housing part 44 can rotate with the shaft but is fixed vertically relative to the barrier body. Thus the encoder 81 will only register a rotation of the drive 5, but will not be influenced by a vertical movement of the drive 5 relative to the barrier body 2.

[0102] In embodiments the barrier module 2 can have at least one position sensor 82 near at least one longitudinal end 83 of the module 2, as for example shown in fig. 5 and 7A. Preferably at least one position sensor 82 is provided near each opposite longitudinal end 83, for defining a relative position of the barrier module 2 relative to a barrier module 2 coupled to said barrier module at said end 83. In the embodiments shown two position sensors 82 can be provided near each longitudinal end of a barrier module 2, one on either side of a vertical mid sectional longitudinal plane V_D of the barrier module 2, as shown in fig. 7A. When two such modules 2 are coupled and extend in a straight line relative to each other, i.e. their longitudinal axis D extending parallel to each other, the distance measured between two sensors 82 at a first side of said vertical mid sectional longitudinal plane V_D at mating ends 83 of the modules 2 will be the same as the distance measured between the two sensors 82 at the opposite side of said plane V_D. If the longitudinal axis D are however at an angle α other than 0 or 180 degrees,

the sets of sensors 82 on opposite sides of said plane V_D will measure different distances between them. From the difference in distance the relative angle α between the connected barrier modules 2 can be calculated.

[0103] In stead of or additionally other sensors can be used for defining the relative angle α of two or more adjacent barrier modules 2, such as for example using a protractor, such as for example an electronic protractor, connected to facing ends 83 of connected barrier modules 2. Alternatively or additionally a relative angle α between two or more barrier modules 2 can be assessed using for example camera views, such as images perceived by a camera 105 provided on the barrier 1 and/or on a worker 123 or equipment 128, 128"or of a camera 104 of a drone 103 flying above the barrier 1. Alternatively gyroscopes can be used or each barrier module 2 can be provided with a GPS device, preferably a GPS device at each of the opposite ends 83 of the module 2.

[0104] Preferably the barrier module 2 is provided with at least one bar 84 extending in a longitudinal direction D1, D2 of the barrier module 2, at least from one longitudinal end 83 of the barrier module 2 towards a central portion of the module 2. More preferably the at least one bar extends from near one longitudinal end 83 of the module 2 to near the opposite longitudinal end 83 of the barrier module 2. The at least one and preferably each of the position sensors 82 can then be mounted to said at least one bar 84.

[0105] Preferably the at least one bar 84 extends through the barrier module body 2C, spaced apart from the outer wall 2A of said body. Preferably the at least one bar 84 has substantially no constructional purpose for the barrier module 2 itself. This means that the impact resistance of the barrier module 2 can be substantially the same with or without said one or more bars 84. The bar or bars 84 in such embodiments serve the purpose of mounting the position sensors 82 near said end or ends 83 in a well defined position relative to each other, irrespective of for example deformations of the barrier outer wall 2A or for example bending or warping of the barrier module body 2C.

[0106] In the embodiment shown the housing 44 is mounted to an inner surface of the barrier wall 2A, near a top end thereof. The housing 44 comprises a relatively open frame 44A, with the support 40 extending through a top part 44B and bottom part 44C thereof, near or at the centre thereof.

[0107] In the embodiments disclosed two bars 84 can be provided, as for example shown in fig. 7A, one on either side of the support 40. The bars 84 are straight and have a longitudinal direction D_{84} extending parallel to the longitudinal direction D of the barrier module 2. The bars 84 extend through the housings 44 and may be suspended by said housings 44, without being attached to the further body 2C. The bars 84 are preferably spaced apart from the wall 11, such that an impact on said wall 11 can cause significant deformation of said wall without deforming the bars 84 and hence without influencing the positions of the sensors 82 relative to each other. In the embodiments shown the bars 84 can be metal bars, and the bars 84 can have a relatively open, light weight but stiff construction, as for example shown in fig. 5. The bar for example can be of a lattice construction, for example a truss-I beam or the like.

[0108] By being able to assess the position of the barrier modules 2 in a barrier 1 relative to each other the shape of the barrier 1 can be assessed accurately.

[0109] For each drive a height sensor 85 can be provided, for sensing the height H of the barrier module body 2C above the drive 5 or above a road surface on which the barrier module 2 is supported by said drives 5. The height sensor 85 can for example be placed on said housing 44, can be connected to the lift mechanism 43, for example for measuring the position, such as an angle of the arm 47 relative to the housing 44 or be connected to or integrated with the motor 50 of the lift module 43.

[0110] In the drawings the height H is indicated as the height of the lower edge 41 of the module body 2C above the road surface 35, 127, near the relevant drive 5. By measuring the height H it can be assured that the barrier module body 2C will be held spaced apart from said road surface 35, 127 during use and thus can be moved over said surface 35, 127 using the drives 5, even when the barrier 1 is used for diverting or rerouting traffic and/or receiving impact upon vehicle collisions.

[0111] The barrier modules are preferably provided with coupling elements 15 at opposite longitudinal ends 83 of the module, for connecting the modules 2 to adjacent modules, as described. The couplings can comprise pins 15A and plates 15B with corresponding holes or openings through which the pins 15A can extend, as known in the art. The plates 15B preferably have openings which are somewhat wider than the pins 15A, such that in horizontal directions some movement of the plate 15B relative to the pins 15A is possible, allowing for pivoting of the barrier modules 2 relative to each other. Preferably at least one of the coupling elements 15 is provided with a lock, preventing the coupling element 15 from being unintentionally released from a coupling element 15 it is coupled with, especially in a substantially vertical direction. In the embodiments shown by way of example only the coupling elements are provided as a pin 15A of one module 2 extending through a hole in a plate 15B of an adjacent module 2, as known in the art, wherein the pin 15A is provided with a through bore 86, through which a locking pin 87 extends. The coupling means 15 can be coupled or decoupled only when the locking pin 87 is removed from the bore 86.

[0112] As can be understood, a barrier 1 can be formed by connected two or more modules 2 to each other. As discussed the modules 2 can and preferably are all provided with at least one drive 5, more preferably at least two drives 5, which can be independently driven but can also be controlled together for driving the barrier 1. A control unit 17 is provided for remote control of the drives 5 and, through receiver 16 for receiving data from some

or all of the sensors 81, 82 and 85 provided in the modules 2. Additionally a control unit 17 can be connected to a transmitter 18 for transmitting data received from for example the sensor 18, 82 and/or 85 to a remote receiver. For example a remote control 100 can be provided for control of the drives 5, for example based inter alia on data received.

[0113] Each module 2 can be provided with such set of a control unit 17, receiver 16 and/or transmitter 18, or a central set of such unit 17, receiver 16 and/or transmitter 18 can be provided. The control unit 17 preferably comprises an algorithm for control of the drives 5 at least in part based on said data received, such as data received from some or all of the sensors 81, 82, 85, and/or data received from external sources such as GPS coordinates, traffic and traffic intensities, drive plans, camera images from a camera 105 or 104 or the like.

[0114] In embodiments in the control unit 17 or control units 17 and/or in the remote control unit 100 positions of the different barrier modules 2 and for example paths of movements of the different modules 2 and/or the barrier 1 comprising such modules 2 can be set, for example predefined, such that the barrier 1 will automatically move itself over a road surface 35, 127 from a first position to a second position. Additionally or alternatively the system can allow a user to manually control the movement of one or more or all of the modules 2 in a barrier, for example relative to each other and/or relative to a road surface 35, 127. Additionally or alternatively an operator can predefine a path for the barrier to follow, after which an algorithm provided in the control unit or units 17 and/or in the remote control 100 can guide the barrier 1 along said path to a destination.

[0115] Figure 4 shows a schematic perspective view of an embodiment of a traffic barrier 1 according to a further aspect of the invention. Like in embodiments shown, the barrier 1 comprises multiple elongate barrier modules 2 connected to each other, and the traffic barrier 1 further comprises drives 5 for moving the barrier modules 2. As can be seen here in for example Figure 4 or 16, during use, when seen from above, the traffic barrier 1 does not need to extend in a straight line and/or does not need to extend parallel with a traffic lane, but may for instance comprise one or more portions or sections 111 substantially forming curves or angled sections 111. Such substantially curved or angled sections 111 may facilitate that a predetermined section or portion 113 of the barrier 1, such as a central barrier portion or section 113, which may extend substantially parallel with a respective traffic lane, may be located relatively nearby a nearest traffic lane 127 to be used by traffic 130, whereas one or more other sections of the barrier 1, in particular a proximal end section 114 and/or a distal end section 115 of the barrier 1 may be spaced apart further from said nearest traffic lane 127, for instance in order to counteract that a vehicle may frontally crash into an end, such as a distal end, of the traffic barrier 1. For instance in order to be shaped as to form such S-curves or so-called S-bends or the like, in embodiments, the traffic barrier 1 may, at least temporary, be flexible to some extent in its longitudinal direction, for example by means of pivots. Preferably, the pivots may be lockable, in particular in order to lock them in order to provide a relatively rigid temporary traffic barrier 1 provided with one or more bent, curved, arched and/or angled barrier sections 111. Alternatively or additionally, the barrier 1 may comprise one or more bent, curved, arched and/or angled barrier parts, such as barrier modules and/or intermediate barrier parts.

[0116] Such a bent, curved, arched and/or angled temporary traffic barrier may for instance move itself substantially in the longitudinal direction of the traffic barrier 1 and/or along the longitudinal direction of the road, preferably in a manner in which said traffic barrier 1 substantially maintains its bent, curved, arched and/or angled shape. For example, the traffic barrier 1 may then be arranged to and/or set to substantially follow one or more predetermined or specific outside entities, for example one or more pieces of working equipment 128, such as for instance a mower 128', a paver for laying asphalt, concrete, an asphalt cutter, etc. In advantageous embodiments, the traffic barrier 1 is rigid, stiff and/or heavy enough that even when it is in a state in which it moves, for instance when it substantially continually moves along with road work or the like, said traffic barrier 1 can substantially withstand impact of an incoming vehicle, at least to a certain predetermined extent, preferably in accordance with national or regional norms for temporary road traffic barriers, such as NEN-EN-1317 or equivalent norms.

[0117] As is shown in fig. 4 a drone 103 with a camera 104 can be used for monitoring the barrier 1 and for example the workers 123 and vehicle 128, 128', traffic 130 and/or the road in general. Information from the drone 103 can then be used in controlling movement of the barrier 1. Additionally or alternatively electronic means such as a camera, GPS receiver, radar device, LiDAR devices, sonar appliances and/or general odometry devices can be provided in and/or on a barrier, schematically indicated by the box 105 in fig. 3, here shown as a camera 105.

[0118] By using a method in which a series of barrier modules 2, forming a barrier 1, is moved alongside workers 123, 128, 128', said workers 123, 128, 128' are protected from vehicles, for example by rerouting traffic on a road surface 35, 127 and/or by protecting against errant vehicles 130. The series of barrier modules 2 is moved over said road surface 35, 127 together with at least some of the workers 123, 128, 128' while said workers are working at or above said road surface or alongside said road surface. By using a barrier 1 or at least barrier modules 2 moving alongside with road workers 123, 128, 128', a longitudinally relatively short barrier 1 can be used, with a limited number of modules 2, with which a long stretch of road can be serviced, i.e. far longer than the length of the barrier 1. Because the barrier modules 2 can stand and move on their drives 5, there

is no need to set up a long stretch of barrier modules 2 or continuously build up a barrier over a shorter stretch of road, perform the work necessary, dismantle the barrier and rebuild the barrier again alongside a next stretch of road for again performing work. Therefore a barrier 1 according to this disclosure is easier to use and safer in use than existing barriers. Both for workers doing road side work as for workers having to set up and remove barriers.

[0119] Figs. 15A - I schematically show a series of steps for setting up a barrier 1 according to the disclosure. In general such method can comprise the steps of placing a first barrier module 2 with the at least one drive 5 on a surface 35, 127, in a first position, moving said first barrier module 2 along said surface 35, 127 to a second position, adjacent the first position, placing a second barrier module 2 on said surface 35, 127 at or near said first position and coupling said second barrier module 2 to said first barrier module 2. Subsequently the coupled first and second barrier modules 2 can be moved along said surface 35, 127, such that the second barrier module 2 is positioned adjacent said first position, and a third barrier module 2 is placed on said surface 35, 127 at or near the first position, and is coupled to the second barrier module 2. During such setting up or removing, as will be discussed later, of a barrier the modules 2 can be moved over the surface by the drives 5 of the modules 2. Alternatively the modules can be pushed and/or pulled during the setting up and/or removal over said surface using an external vehicle.

[0120] In fig. 15 such method is disclosed schematically for three modules 2, each module 2 provided with two drives 5. In fig. 15A a transport vehicle 106 carrying three modules 2_I, 2_{II} and 2_{III} is positioned on a road surface 35, 127 next to a first position A. Then in fig. 15B the first module 2_I is lifted off the vehicle 106 and placed on the first position A, supported by its drives 5. Fig. 15C shows the first module 2_I on said first position A.

[0121] While the transport vehicle 106 can be stationary during these steps, as is shown in fig. 15D the first barrier module 2_I is moved, substantially in its longitudinal direction D, to a second position B next to the first position A, in fig. 15 to the right hand side of the drawing. Then a second module 2_{II} is lifted from the vehicle 106, into the first position A next to the first module 2_I, as shown in fig. 15E. The second module 2_{II} is again supported by its drives 5.

[0122] As is further elucidated in fig. 8A - D, the modules 2 can easily be connected to each other using the couplings 15, by adjusting the height and relative positions of the modules using the drives 5 and lift modules 43. The first module 2_I or at least the relevant longitudinal end thereof can be lowered in height H, whereas and/or the second module 2_{II} can be raised in height, at least the relevant longitudinal end 83 thereof (fig. 8B) such that a coupling pin 15A of the second module 2_{II} can be moved under a coupling plate 15B of the first module 2_I (fig. 8C) such that when the second module 2_{II} is lowered again and/or the first module 2_I is raised again, the pin 15A can extend through a hole in the plate 15B, thus coupling the modules 2_I, 2_{II} (Fig. 8D)

[0123] As is shown in fig. 15F a connection, especially a connection W for transferring electricity and data can be made between the modules 2_I, 2_{II}, for example in order to connect sensors 81, 82 and/or 85 of the modules 2_I, 2_{II} and or control units 17 thereof. In fig. 15F such connection is schematically shown by way of a curled elastic wire W, but other connections are also possible, such as for example a wireless connection or with a plug and socket connection.

[0124] After the modules 2_I, 2_{II} have been properly connected as shown in fig. 15G, the two coupled first and second modules 2_I, 2_{II} are again moved in substantially longitudinal direction D, in fig. 15 to the right of the drawing, such that the second module 2_{II} is moved off the first position A to the second position B, as shown in fig. 15H. Thus the first position A is made available for positioning of the third module 2_{III} on the first position A, which can then be coupled to the free end 83 of the second module 2_{II} as described before.

[0125] It shall be clear that with this method any suitable number of barrier modules 2_I to 2_n can be connected in series by repeating these steps. Prior to or during movement of one or more modules 2 during these steps some of the modules 2 can be moved partly side ways too, for example in order to form a curved, bent or hooked configuration and/or in order to follow for example a bent or curve in a road surface, such as for example shown in fig. 4 and 16. Similarly the height H of a barrier module 2 can be adjusted in order to for example navigate over a bump or groove in the road surface, in order to navigate a sloping part of the road surface or to pass over another obstacle. When each drive 5 is provided with or connected to a lift module 43, the height H of the module 2 can be varied along its length.

[0126] This method has the advantage that the transport vehicle 106 can be placed stationary at a safe location, for example alongside a road on an emergency lane, hard shoulder or emergency harbor, whereas the barrier can be driven away from said transport vehicle 106, alongside and/or over said road surface 35, 127, to a position in which it is to be used. As discussed, since the modules 2 can move in all substantial horizontal directions, i.e. parallel to said road surface using their drives 5, as well as be adjusted in height H, during use the barrier 1 can be moved from a storage position and/or set up position, for example on a hard shoulder, emergency lane 120 or parking bay 110, service station or side road or any other relatively safe position away from traffic lanes in use, to a use position, for example alongside a traffic lane 125, either a permanent or temporary traffic lane 125, as shown for example in fig. 16. At such use position it can be made stationary for a period of time, after which it can be moved either to another use position or to a storage position, for example a storage position it came from. Alternatively it can be moved alongside work-

ers 123, 128, 128', as described before for example in relation to fig. 4, de facto providing for a moving use position.

[0127] In a method according to the disclosure a barrier 1 comprising a series of barrier modules 2 with drive units 5 as disclosed can be moved over a road surface together with at least some of the workers 123, 128, 128' and/or equipment 126 while said workers 123, 128, 128' are working at or above said road surface or alongside said road surface, as for example shown in fig. 4. In such method the overall length of the barrier 1, measured in the longitudinal direction of the modules 2, can be relatively limited compared to the length of the road surface on which work has to be performed. For example the length need not be much more than the length occupied by the workers and equipment. As can be seen in fig. 4 the barrier 1 can be curved around the workers and equipment 125, 126, 128, 128' such that they are protected from traffic moving alongside the barrier 1. Such movement has also been described here before with respect to fig 4 and 16. Since the drive units 5 can individually be set for a driving direction, the barrier 1 can move in the said longitudinal direction maintaining the bent or curved configuration, or can adapt the configuration based on for example changing road surface, traffic conditions, equipment and/or workers active on and/or above said road surface or the like.

[0128] By way of example, without limiting the disclosure in any way or form, if for example alongside a road an emergency lane needs to be worked on, for example for cleaning, or grass alongside the road has to be mowed, over hundreds of meters or even kilometers of road, a barrier 1 can be used having a length of tens of meters, for example comprising a limited number of barrier modules 2, which can be curved around a cleaning or mowing vehicle 123, and can move with and alongside said vehicle while cleaning or mowing. Obviously in a similar fashion a barrier can move alongside other workers and/or equipment, such as but not limited to during road repair, tarmacking, striping, accident assistance and the like. The barrier 1 can during such operation be supported at all times by the drives, or can for example intermittently be lifted by the drive units, moved over a distance and then lowered again, such that a lower side of the barrier modules comes to rest on the road surface again.

[0129] When removing a traffic barrier from a road surface 35 a similar method can be used as described before for setting up a barrier, as elucidated by fig. 14, in reverse order. Such method for removing a barrier 1 can comprise the steps of decoupling a first barrier module 2_I from at least a second barrier module 2_{II} in said series of barrier modules, i.e. from the remaining barrier 1, with the first barrier module 2_I in a first position A. Said first position A can again be a position next to a stationary transport vehicle 106, as shown in fig. 15I. Then the first barrier module 2_I can be removed from said first position A and lifted onto the transport vehicle 106. The remaining series of the coupled barrier modules 2 is then moved along said surface, such that the second barrier module 2_{II} is moved at least substantially to said first position A, similar to fig. 15G. When the second barrier module is positioned substantially at said first position A, it is decoupled from a third barrier element 2_{III} of said series, and is removed from the first position A, lifted onto the vehicle 106, similar to fig. 15E. The remaining series of the coupled barrier modules 2 is then moved along said surface, such that the third barrier module 2_{III} is moved at least substantially to said first position A to be lifted onto the vehicle 106.

[0130] In these methods the transport vehicle 106 is positioned next to the first position A, which transport vehicle 106 supplies barrier modules 2 to be positioned at the first position A and/or receives barrier modules 2 removed from the first position A. Obviously any number of modules 2 can thus be supplied and/or removed.

[0131] During movement of the barrier in use one or more of the drives 5 could be lifted temporarily while supporting the modules 2 on further drives 5, for example to pass an obstacle on the road surface 35, 127, or for example to stay free from such obstacle, which could for example be a relatively soft patch of said road surface, such as for example a newly prepared surface part of the road, an expansion joint or fresh paint. The barrier 1 can then still be supported by and moved by further drives 5.

[0132] In the present disclosure methods are described for protecting workers from errant vehicles and/or for rerouting traffic on a road surface, using a series of connected barrier modules 2, each barrier module 2 provided with at least one, preferably at least two drives 5, wherein the series of barrier modules 2 is preferably supported on the road surface by their drives 5 only. The drives 5 are preferably independently drivable. The barrier modules 2 have two opposite lower side edges 41 which, during use of the barrier modules for receiving vehicle impact, extend at least a number of centimeters from the road surface 35, 127. This means that the barrier module body 2C is suspended above the surface 35, 127 over a height H, which is preferably adjustable, and is supported by the drives 5 only.

[0133] A barrier 1 according to the present disclosure preferably can be set up and/or dismantled at a first location, preferably remote from a second location at which the barrier is used for diverting or rerouting traffic and/or protecting workers from errant vehicles, as for example shown in fig. 16. The barrier 1 can be moved on the drives 5 between the first and second positions, as indicated for example in fig. 16 by the dashed lines P.

[0134] It should be understood that the barriers 1 can also be used for protecting vehicles, equipment, buildings and the like structures or such artefacts from such errant vehicles. This has to be understood as being included by protecting workers.

[0135] In embodiments a barrier 1 or barrier module 2 according to the description can be used in combination with a fixed barrier or a stationary, temporary barrier, for

example for forming part of a barrier assembly, which part can move in order to divert or reroute traffic from one traffic lane to another traffic lane. A barrier of the disclosure can also be used for shielding for example a part of a road, such as a traffic lane, or an area from view, for example in case of a road accident, especially when panels 35 are provided, which may be solar panels or other panels, preferably non-transparent panels.

[0136] A drive 5 for a barrier module 2 or barrier 1 according to the disclosure can be a separate drive unit or module 5, which module 5 can but need not include a lift module 43. Such module can be mounted to a barrier module 2, such as for example a known concrete or metal barrier body as for example known from NL1006481. The module can be provided such that it can be integrated into the barrier module 2 or such that it can be an add on module, which can for example be temporarily attached to a barrier module 2. Such drive module 5 can comprise at least a base 53 with a left side drive 56 and a right side drive 57, each comprising at least a drive wheel 58 and a driven wheel 59, and at least a motor 61 connected to the relevant drive wheel 58 through a gearing 61, wherein the left side drive 56 and the right side drive 57 are independently drivable. Preferably each of the left side drive 56 and the right side drive 57 comprises a track 7 extending around the respective drive wheel 58 and driven wheel 59.

[0137] In a barrier 1 or barrier module 2 drives 5 can be used in which the lift 19 or lift module 43 with the support 40 can be combined with the drive 5, especially with the carrier 53 with the sets of wheels 7, integrated into a drive unit. This enables easy movement of the barrier modules or barrier, for example over uneven surfaces. The drive units 5 will allow changes in height position of individual drives 5 even during movement of the barrier modules or barrier.

[0138] It is noted that for the purpose of clarity and a concise description features are described herein as part of the same or separate embodiments, however, it will be appreciated that the scope of the invention may include embodiments having combinations of all or some of the features described. For example, the skilled person understands that elements or features disclosed in the context of one embodiment of the traffic barrier 1 or the barrier module 2 or the method for relocating the barrier can also be employed in another embodiment of the method, the barrier module 2 or the traffic barrier 1.

[0139] As described, the traffic barrier may be arranged for moving at least one of the barrier modules, and preferably at least a section comprising multiple barrier modules, more preferably substantially the entire traffic barrier, in a direction substantially transverse to the longitudinal direction of one or more of the barrier modules. This may for instance also facilitate that the traffic barrier can be assembled on another place than the exact spot where it is to be used initially.

[0140] Additionally or alternatively, enabling adjusting the direction of the rolling elements may facilitate that the traffic barrier can make turns, for instance in order to follow bends in the road when the barrier moves substantially in its longitudinal direction.

[0141] Further, it is noted that the invention is not restricted to the embodiments described herein. It will be understood that many variants are possible.

[0142] As an example, the barrier 1 may be provided with an end module or end element, which may beveled, sloped or slanted in the longitudinal direction, more or less like a conventional end-terminal 127 shown in Figure 1, such as to counteract lethal damage to passengers of a vehicle crashing into the distal or proximal end of the barrier 1. Alternatively or additionally, an impact buffer module, for instance including a crash cushion which can at least partly absorb the impact force of a vehicle having a frontal impact with the buffer module, may be provided at the distal and/or the proximal end of the traffic barrier in order to protect in-coming traffic.

[0143] A barrier 1 according to the disclosure can comprise both modules 2 comprising at least one drive 5 as disclosed, as well as other barrier modules 2, for example one or more barrier modules 2 without such drive 5, for example coupled between and suspended by adjacent barrier modules 2 comprising such drives 5.

[0144] Barrier modules according to the disclosure may be used separately, i.e. in uncoupled condition, for example if a collision expected for such barrier module is sufficiently light for the barrier module to accommodate separately. This could for example be used when used alongside cycle paths or the like light traffic areas, or where traffic moves at low speed, like car parks.

Claims

1. Method for protecting workers and/or equipment from errant vehicles and/or rerouting traffic on a road surface (35), using a series of connected barrier modules (2), each barrier module (2) provided with at least one drive unit (5), **characterized in that** the series of barrier modules (5) are supported on the road surface (35) by their drive units only (5), at least during such use as a temporary traffic barrier.

2. Method according to claim 1, wherein the barrier modules have two opposite lower side edges (41), during use of the barrier modules (2) for receiving vehicle impact extending at least a number of centimeters from the road surface (35).

3. Method according to claim 1 or 2, wherein the series of barrier modules (2) is moved over said road surface (35) together with at least workers and/or equipment while said workers and/or equipment are working at or above said road surface or alongside said road surface.

4. Method according to claim 3, wherein said series of

connected barrier modules (2) is moved over said road surface (35) in at least a first direction (D_1, D_2) substantially parallel to a longitudinal direction of said series of connected barrier modules (2).

5. Method according to claim 3 or 4, wherein the series of connected modules (2) comprises at least one bent or curve formed by said connected modules (2), wherein said bent or curve is maintained during movement of the series of barrier modules (2) over said road surface (35).

6. Method according to any one of the preceding claims, comprising the steps of:

- placing a first barrier module (2_1)with the at least one drive (5) on a surface (35), in a first position (A);
- moving said first barrier module (2_1) along said surface (35) to a second position (B), adjacent the first position (A);
- placing a second barrier module (2_2) on said surface (35) at or near said first position (A) and coupling said second barrier module (2_2) to said first barrier module (2_1).

7. Method according to claim 6, wherein the coupled first and second barrier modules (2_1, 2_2) are moved along said surface (35), such that the second barrier module (2_2) is positioned adjacent said first position (A), and a third barrier module (2_3) is placed on said surface (35) at or near the first position (A), coupled to the second barrier element (2_2).

8. Method according to any one of the preceding claims, wherein after use of the barrier (101) the barrier (101) is removed, wherein the removing comprises the steps of:

- decoupling a first barrier module (2_1) from at least a second barrier module (2_2) in said series of barrier modules with the first barrier module (2_1) in a first position (A) on a surface (35);
- removing the first barrier module (2_1) from said first position (A);
- moving a remaining series of the coupled barrier modules (2) along said surface (35), such that the second barrier module (2_2) is moved at least substantially to said first position (A).

9. Method according to claim 8, wherein the second barrier module (2_2) positioned substantially at said first position (A) is decoupled from a third barrier element (2_3) of said series, and is removed from the first position (A), and moving a remaining series of the coupled barrier modules (2) along said surface (35), such that the third barrier module (2_3) is moved at least substantially to said first position (A).

10. Method according to any one of the claims 6 - 9, wherein a transport vehicle (106) is positioned next to the first position (A), which transport vehicle (106) supplies barrier modules (2) to be positioned at the first position (A) and/or receives barrier modules (2) removed from the first position (A).

11. Method according to any one of the preceding claims, wherein the barrier (101)is set up at a first location connecting the series of barrier modules (2) longitudinally, each barrier module (2) provided with said at least one drive unit (5) supporting the module (2) on a surface (35), where after the series of modules (2) is moved over said surface (35), driven by said drives (5), from the first location (A) to a second location (B) at which the barrier (101) is used as a temporary traffic barrier.

12. Method according to claim 11, wherein after use as a temporary traffic barrier (101) at the second location, the barrier (101) is moved over said surface from the second location back to the first location or further to a third location remote from the first and second location, for temporary parking of said barrier (101).

13. Method according to claim 11 or 12, wherein the barrier (101) is moved over the surface (35) at the second location by using the drive units (5), during use as a temporary traffic barrier (101).

14. Traffic barrier module (2) for protecting workers from errant vehicles and/or for rerouting traffic, configured for use in a method of any one of the preceding claims, wherein the traffic barrier module (2) comprises at least one drive unit (5), preferably at least two drives for moving the barrier module (2) along a road surface (35), wherein the or each drive unit (5) comprises at least two sets of wheels or tracks (7), preferably independently drivable for orienting a driving direction of the drive, and a support (40) for supporting the barrier module (2) on the drive unit (5), wherein a lift module (43) is provided for each drive (5) to lift the relevant barrier module relative to said drive, wherein the at least one drive unit (5) is self-breaking.

15. Traffic barrier module according to claim 14, wherein each set of wheels or tracks (7) is provided with an electric motor (60) and gearing (62), especially a speed reducing gearing.

Patentansprüche

1. Verfahren zum Schutz von Arbeitern und/oder Ausrüstungen vor umherfahrenden Fahrzeugen und/oder zur Umleitung des Verkehrs auf einer Straßenoberfläche (35) unter Verwendung einer Reihe von

miteinander verbundenen Barrieremodulen (2), wobei jedes Barrieremodul (2) mit zumindest einer Antriebseinheit (5) versehen ist, **dadurch gekennzeichnet, dass** die Reihe von Barrieremodulen (5) auf der Straßenoberfläche (35) nur durch ihre Antriebseinheiten (5) zumindest während einer solchen Verwendung als vorübergehende Verkehrsbarriere gestützt wird.

2. Verfahren nach Anspruch 1, wobei die Barrieremodule zwei gegenüberliegende untere Seitenkanten (41) aufweisen, die sich während der Verwendung der Barrieremodule (2) zur Aufnahme eines Fahrzeugaufpralls zumindest einige Zentimeter von der Straßenoberfläche (35) erstrecken.

3. Verfahren nach Anspruch 1 oder 2, wobei die Reihe von Barrieremodulen (2) zusammen mit zumindest Arbeitern und/oder Ausrüstungen über die Straßenoberfläche (35) bewegt wird, während die Arbeiter und/oder die Ausrüstungen auf oder über der Straßenoberfläche oder entlang der Straßenoberfläche tätig sind.

4. Verfahren nach Anspruch 3, wobei die Reihe verbundener Barrieremodule (2) über die Straßenoberfläche (35) in zumindest einer ersten Richtung (D_1, D_2) bewegt wird, die im Wesentlichen parallel zu einer Längsrichtung der Reihe verbundener Barrieremodule (2) verläuft.

5. Verfahren nach Anspruch 3 oder 4, wobei die Reihe verbundener Module (2) zumindest eine Biegung oder Kurve umfasst, die durch die verbundenen Module (2) gebildet wird, wobei die Biegung oder Kurve während der Bewegung der Reihe von Barrieremodulen (2) über die Straßenoberfläche (35) beibehalten wird.

6. Verfahren nach einem der vorhergehenden Ansprüche, das die folgenden Schritte umfasst:

- Platzieren eines ersten Barrieremoduls (2_1) mit dem zumindest einen Antrieb (5) auf einer Fläche (35) in einer ersten Position (A);
- Bewegen des ersten Barrieremoduls (2_1) entlang der Fläche (35) in eine zweite Position (B), die an die erste Position (A) angrenzt;
- Platzieren eines zweiten Barrieremoduls (2_2) auf der Oberfläche (35) an oder in der Nähe der ersten Position (A) und Verbinden des zweiten Barrieremoduls (2_2) mit dem ersten Barrieremodul (2_1).

7. Verfahren nach Anspruch 6, wobei die gekoppelten ersten und zweiten Barrieremodule (2_1, 2_2) entlang der Oberfläche (35) bewegt werden, so dass das zweite Barrieremodul (2_2) neben der ersten Position (A) positioniert wird, und ein drittes Barrieremodul (2_3) auf der Oberfläche (35) an oder in der Nähe der ersten Position (A) platziert und mit dem zweiten Barrieremodul (2_2) gekoppelt wird.

8. Verfahren nach einem der vorhergehenden Ansprüche, wobei nach der Verwendung der Barriere (101) die Barriere (101) entfernt wird, wobei das Entfernen die folgenden Schritte umfasst:

- Entkoppeln eines ersten Barrieremoduls (2_1) von zumindest einem zweiten Barrieremodul (2_2) in der Reihe von Barrieremodulen, wobei sich das erste Barrieremodul (2_1) in einer ersten Position (A) auf einer Oberfläche (35) befindet;
- Entfernen des ersten Barrieremoduls (2_1) von der ersten Position (A);
- Bewegen einer verbleibenden Reihe der gekoppelten Barrieremodule (2) entlang der Oberfläche (35), so dass das zweite Barrieremodul (2_2) zumindest im Wesentlichen in die erste Position (A) bewegt wird.

9. Verfahren nach Anspruch 8, wobei das zweite Barrieremodul (2_2), das im Wesentlichen an der ersten Position (A) positioniert ist, von einem dritten Barrieremodul (2_3) der Reihe entkoppelt wird und aus der ersten Position (A) entfernt wird, und Bewegen einer verbleibenden Reihe der gekoppelten Barrieremodule (2) entlang der Oberfläche (35), so dass das dritte Barrieremodul (2_3) zumindest im Wesentlichen in die erste Position (A) bewegt wird.

10. Verfahren nach einem der Ansprüche 6 bis 9, wobei neben der ersten Position (A) ein Transportfahrzeug (106) positioniert wird, wobei das Transportfahrzeug (106) an der ersten Position (A) zu positionierende Barrieremodule (2) zuführt und/oder aus der ersten Position (A) entfernte Barrieremodule (2) aufnimmt.

11. Verfahren nach einem der vorhergehenden Ansprüche, wobei die Barriere (101) an einer ersten Stelle aufgestellt wird, der die Reihe von Barrieremodulen (2) in Längsrichtung verbindet, wobei jedes Barrieremodul (2) mit der zumindest einen Antriebseinheit (5) versehen ist, die das Modul (2) auf einer Fläche (35) abstützt, wonach die Reihe von Modulen (2) über die Oberfläche (35), angetrieben durch die Antriebe (5), von der ersten Stelle (A) zu einer zweiten Stelle (B) bewegt wird, an der die Barriere (101) als vorübergehende Verkehrsbarriere verwendet wird.

12. Verfahren nach Anspruch 11, wobei die Barriere (101) nach der Verwendung als vorübergehende Verkehrsbarriere (101) an der zweiten Stelle über die Oberfläche von der zweiten Stelle zurück zur ersten Stelle oder weiter zu einer dritten, von der ersten und zweiten Stelle entfernten Stelle bewegt

wird, um die Barriere (101) vorübergehend zu parken.

13. Verfahren nach Anspruch 11 oder 12, wobei die Barriere (101) mit Hilfe der Antriebseinheiten (5) über die Fläche (35) an der zweiten Stelle während der Verwendung als vorübergehende Verkehrsbarriere (101) bewegt wird.

14. Verkehrsbarrierenmodul (2) zum Schutz von Arbeitern vor umherfahrenden Fahrzeugen und/oder zur Umleitung des Verkehrs, ausgebildet zur Verwendung in einem Verfahren nach einem der vorhergehenden Ansprüche, wobei das Verkehrsbarrierenmodul (2) zumindest eine Antriebseinheit (5), vorzugsweise zumindest zwei Antriebe zum Bewegen des Barrieremoduls (2) entlang einer Straßenoberfläche (35), umfasst, wobei die oder jede Antriebseinheit (5) zumindest zwei Sätze von Rädern oder Schienen (7), die vorzugsweise unabhängig voneinander antreibbar sind, um eine Antriebsrichtung des Antriebs auszurichten, und eine Stütze (40) zum Abstützen des Barrieremoduls (2) auf der Antriebseinheit (5) umfasst, wobei für jeden Antrieb (5) ein Hubmodul (43) vorgesehen ist, um das betreffende Barrieremodul relativ zu dem Antrieb anzuheben, wobei die zumindest eine Antriebseinheit (5) selbstbremsend ist.

15. Verkehrsbarrierenmodul nach Anspruch 14, wobei jeder Satz von Rädern oder Schienen (7) mit einem Elektromotor (60) und einem Getriebe (62), insbesondere einem Untersetzungsgetriebe, versehen ist.

Revendications

1. Procédé de protection des travailleurs et/ou des équipements contre des véhicules errants et/ou pour dévier la circulation des véhicules sur une surface de route (35), utilisant une série de modules de barrière (2) reliés entre eux, chaque module de barrière (2) étant pourvu d'au moins une unité d'entraînement (5), **caractérisé en ce que** la série de modules de barrière (5) est supportée sur la surface de route (35) uniquement par leurs unités d'entraînement (5), au moins pendant une telle utilisation comme barrière de circulation temporaire.

2. Procédé selon la revendication 1, dans lequel les modules de barrière présentent deux bords latéraux inférieurs opposés (41), pendant l'utilisation des modules de barrière (2) pour recevoir un impact de véhicule s'étendant au moins sur un certain nombre de centimètres à partir de la surface de route (35).

3. Procédé selon la revendication 1 ou 2, dans lequel la série de modules de barrière (2) est déplacée sur ladite surface de route (35) conjointement avec au moins des travailleurs et/ou des équipements pendant que lesdits travailleurs et/ou équipements travaillent sur ou au-dessus de ladite surface de route ou le long de ladite surface de route.

4. Procédé selon la revendication 3, dans lequel ladite série de modules de barrière connectés (2) est déplacée sur ladite surface de route (35) dans au moins une première direction (D_1, D_2) sensiblement parallèle à une direction longitudinale de ladite série de modules de barrière connectés (2).

5. Procédé selon la revendication 3 ou 4, dans lequel la série de modules connectés (2) comprend au moins un coude ou une courbe formé(e) par lesdits modules connectés (2), ledit coude ou ladite courbe étant maintenu pendant le déplacement de la série de modules de barrière (2) sur ladite surface de route (35).

6. Procédé selon l'une quelconque des revendications précédentes, comprenant les étapes consistant à :

placer un premier module de barrière (2_1) avec le ou les unités d'entraînement (5) sur une surface (35), dans une première position (A) ;
déplacer ledit premier module de barrière (2_1) le long de ladite surface (35) jusqu'à une seconde position (B), adjacente à la première position (A) ;
placer un deuxième module de barrière (2_2) sur ladite surface (35) au niveau ou à proximité de ladite première position (A) et coupler ledit deuxième module de barrière (2_2) audit premier module de barrière (2_1).

7. Procédé selon la revendication 6, dans lequel les premier et deuxième modules de barrière couplés (2_1, 2_2) sont déplacés le long de ladite surface (35), de telle sorte que le deuxième module de barrière (2_2) soit positionné adjacent à ladite première position (A), et un troisième module de barrière (2_3) est placé sur ladite surface (35) au niveau ou à proximité de la première position (A), couplé au deuxième module de barrière (2_2).

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel après utilisation de la barrière (101), la barrière (101) est retirée, le retrait comprenant les étapes consistant à :

découpler un premier module de barrière (2_1) d'au moins un deuxième module de barrière (2_2) dans ladite série de modules de barrière avec le premier module de barrière (2_1) dans une pre-

mière position (A) sur une surface (35) ;
retirer le premier module de barrière (2_1) de ladite première position (A) ;
déplacer une série restante des modules de barrières couplés (2) le long de ladite surface (35), de telle sorte que le deuxième module de barrière (2_2) soit déplacé au moins sensiblement jusqu'à ladite première position (A).

9. Procédé selon la revendication 8, dans lequel le deuxième module de barrière (2_2) positionné sensiblement à ladite première position (A) est découplé d'un troisième module de barrière (2_3) de ladite série, et est retiré de la première position (A), et déplacer une série restante des modules de barrières couplés (2) le long de ladite surface (35), de telle sorte que le troisième module de barrière (2_3) soit déplacé au moins sensiblement jusqu'à ladite première position (A).

10. Procédé selon l'une quelconque des revendications 6 à 9, dans lequel un véhicule de transport (106) est positionné à côté de la première position (A), lequel véhicule de transport (106) fournit des modules de barrières (2) à positionner à la première position (A) et/ou reçoit des modules de barrières (2) retirés de la première position (A).

11. Procédé selon l'une quelconque des revendications précédentes, dans lequel la barrière (101) est installée à un premier emplacement reliant la série de modules de barrière (2) longitudinalement, chaque module de barrière (2) étant pourvu d'au moins une unité d'entraînement (5) supportant le module (2) sur une surface (35), après quoi la série de modules (2) est déplacée sur ladite surface (35), entraînée par lesdits unités d'entraînement (5), du premier emplacement (A) à un deuxième emplacement (B) auquel la barrière (101) est utilisée comme barrière de circulation temporaire.

12. Procédé selon la revendication 11, dans lequel après utilisation comme barrière de circulation temporaire (101) au deuxième emplacement, la barrière (101) est déplacée sur ladite surface du deuxième emplacement de nouveau au premier emplacement ou plus loin vers un troisième emplacement éloigné du premier et du deuxième emplacement, pour le stationnement temporaire de ladite barrière (101).

13. Procédé selon la revendication 11 ou 12, dans lequel la barrière (101) est déplacée sur la surface (35) au deuxième emplacement en utilisant les unités d'entraînement (5), pendant l'utilisation comme barrière de circulation temporaire (101).

14. Module de barrière de circulation (2) pour protéger les travailleurs contre les véhicules errants et/ou pour rediriger la circulation, configuré pour être utilisé dans un procédé selon l'une quelconque des revendications précédentes, dans lequel le module de barrière de circulation (2) comprend au moins une unité d'entraînement (5), de préférence au moins deux unités d'entraînement pour déplacer le module de barrière (2) le long d'une surface de route (35), dans lequel la ou chaque unité d'entraînement (5) comprend au moins deux ensembles de roues ou de chenilles (7), de préférence pouvant être entraînés indépendamment pour orienter une direction d'entraînement de l'entraînement, et un support (40) pour supporter le module de barrière (2) sur l'unité d'entraînement (5), dans lequel un module de levage (43) est prévu pour chaque unité d'entraînement (5) pour soulever le module de barrière concerné par rapport à ladite unité d'entraînement, dans lequel le ou les unités d'entraînement (5) sont auto-freinant.

15. Module de barrière de circulation selon la revendication 14, dans lequel chaque ensemble de roues ou de chenilles (7) est pourvu d'un moteur électrique (60) et d'un engrenage (62), en particulier d'un engrenage réducteur de vitesse.

Fig. 1

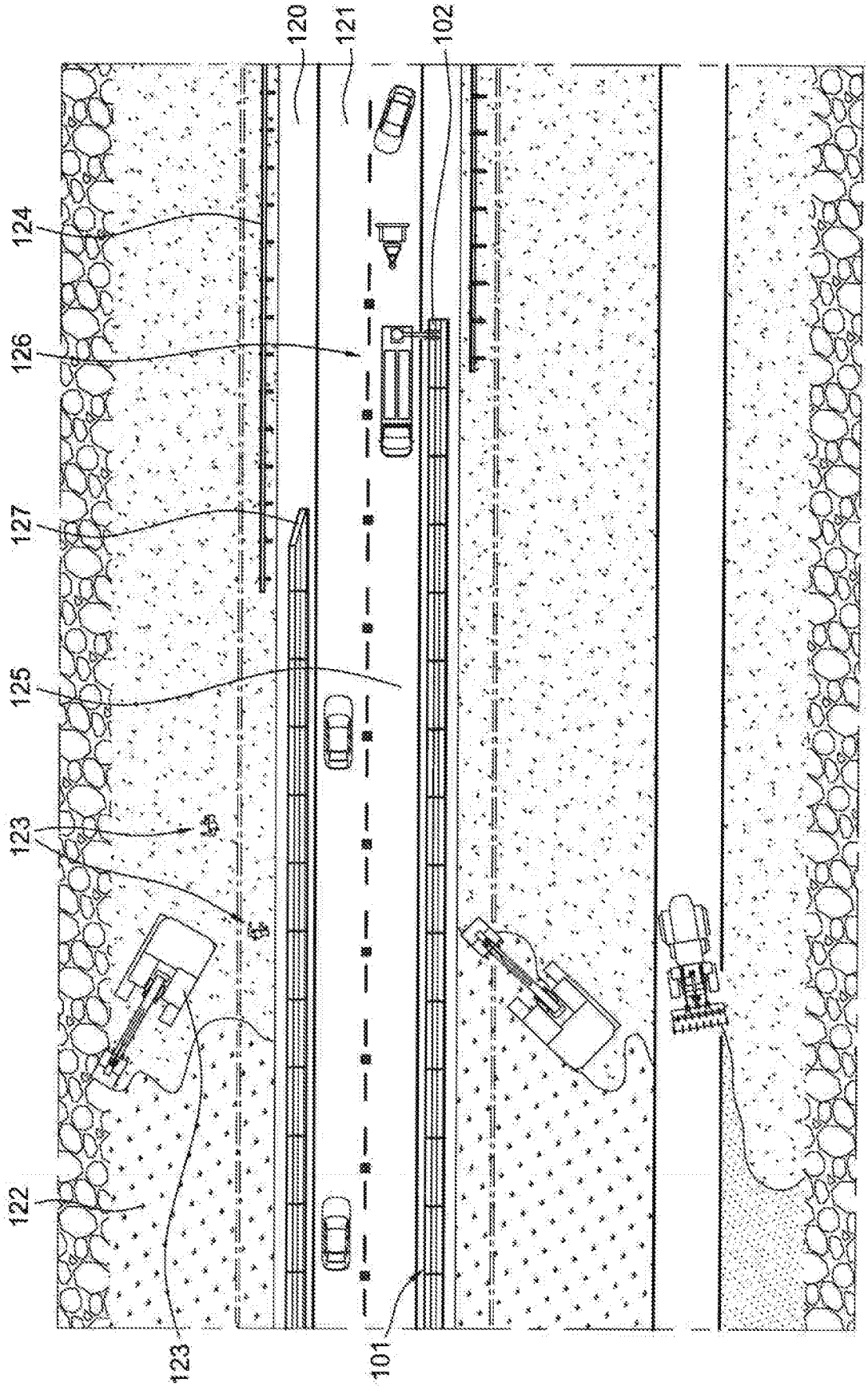


Fig. 2

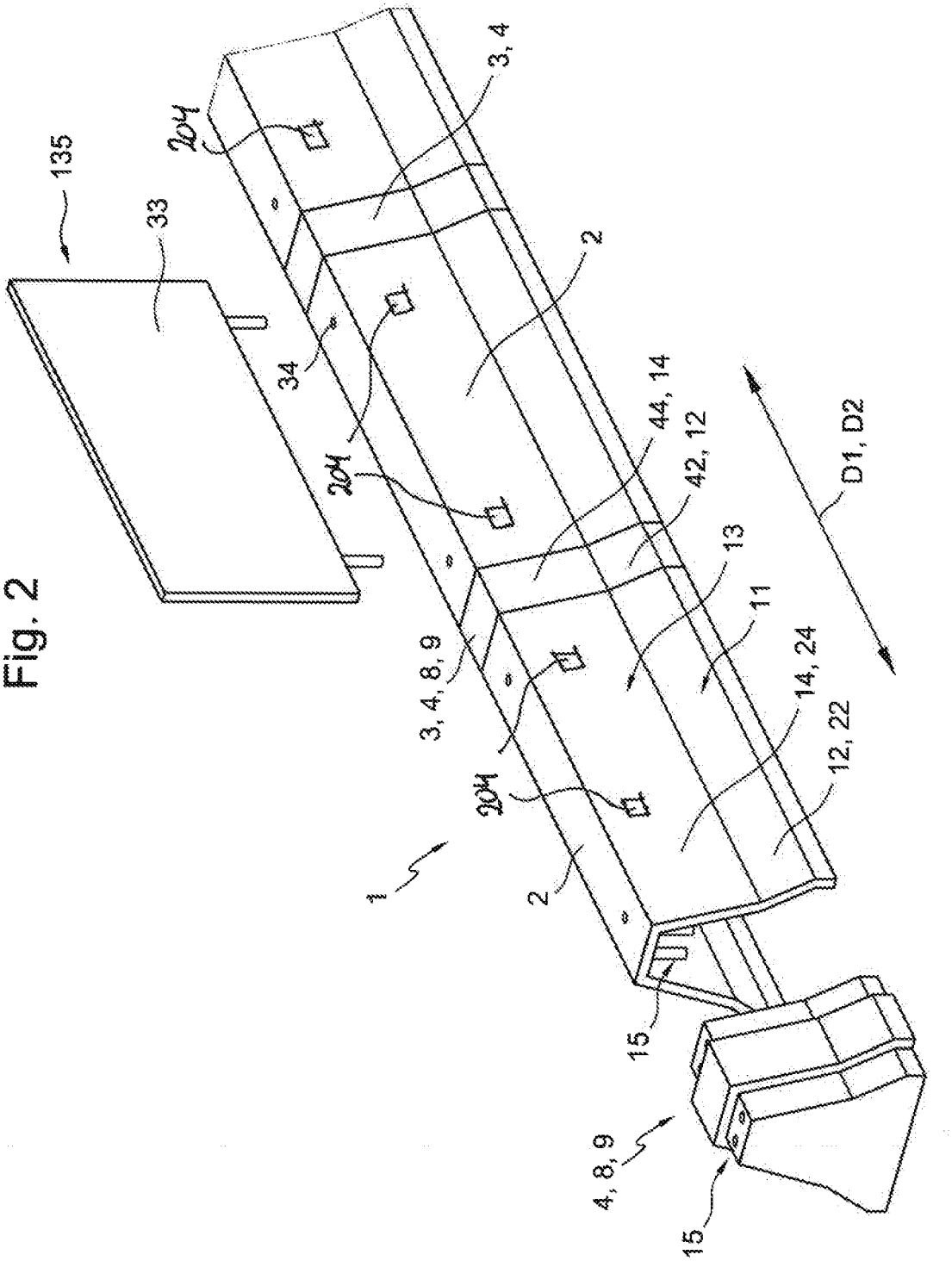


Fig. 3

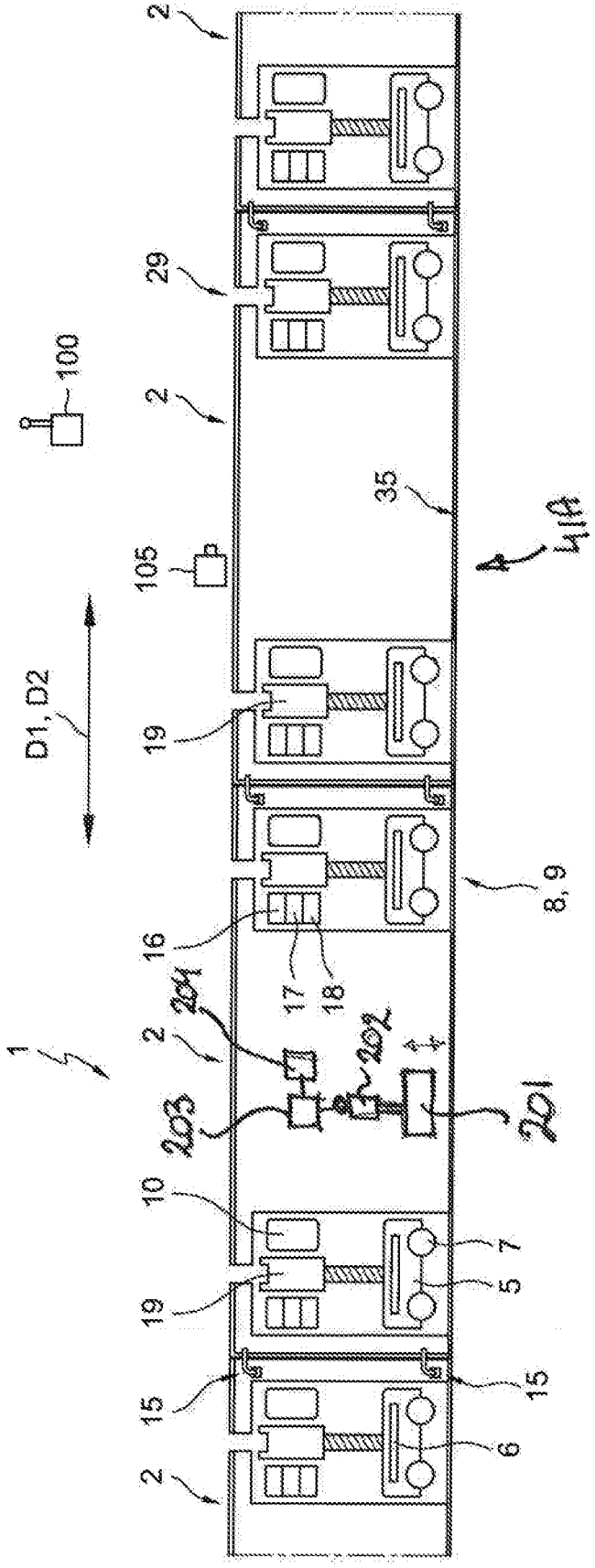


Fig. 4

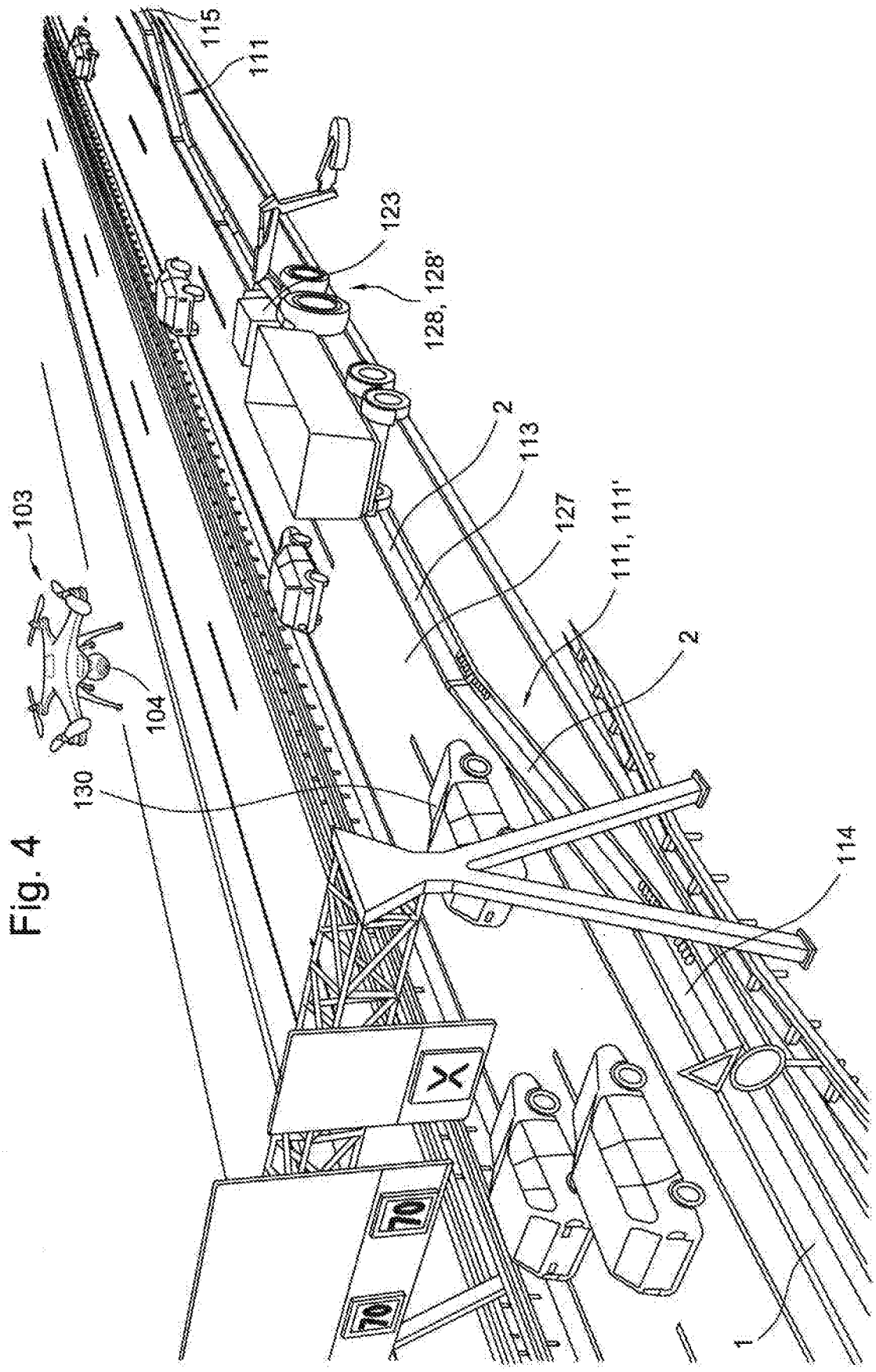
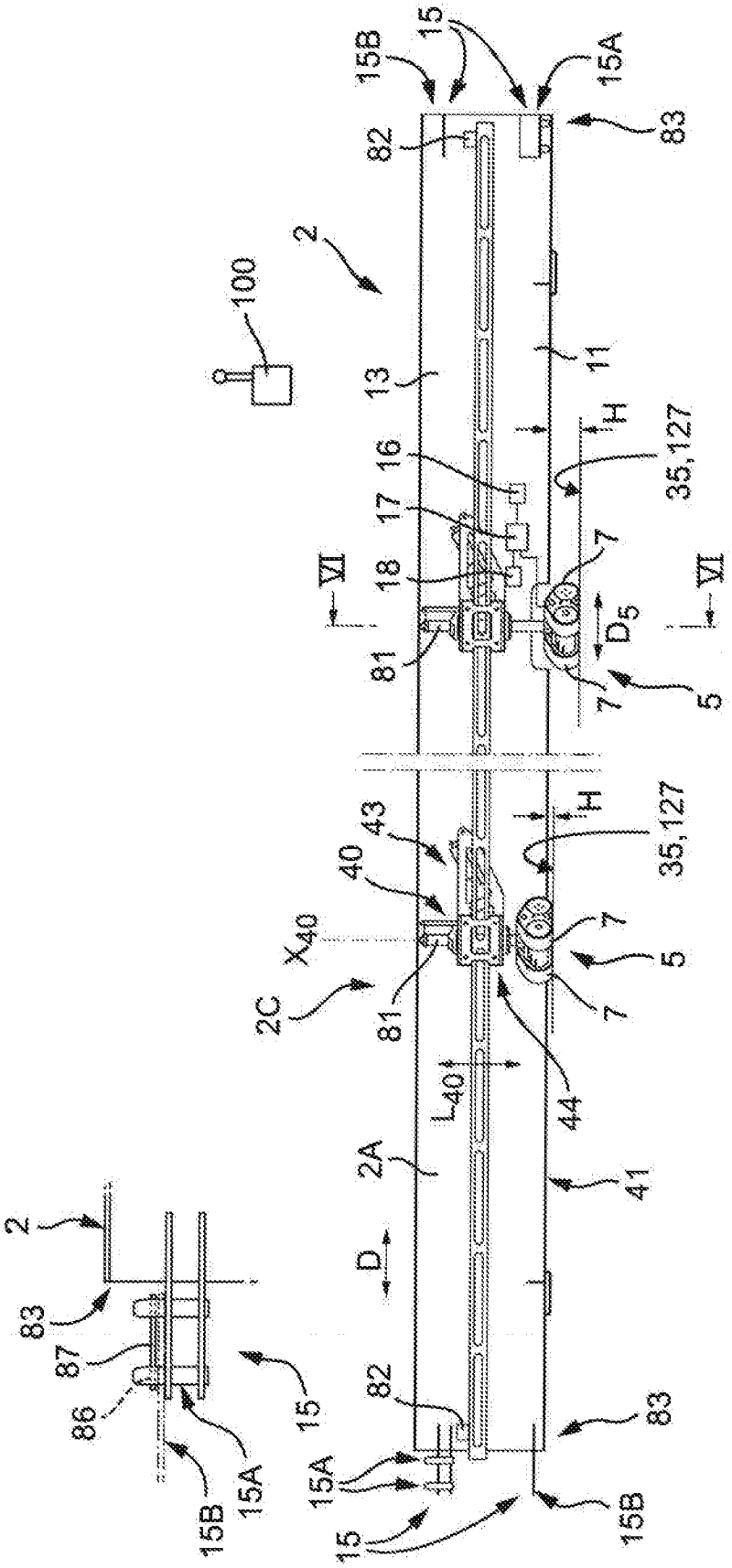


Fig. 5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15
15A
83
82
2
100
13
11
H
35,127
16
17
18
VI
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D5
5
43
40
X40
2C
L40
44
2A
41
D
87
86

Fig. 6

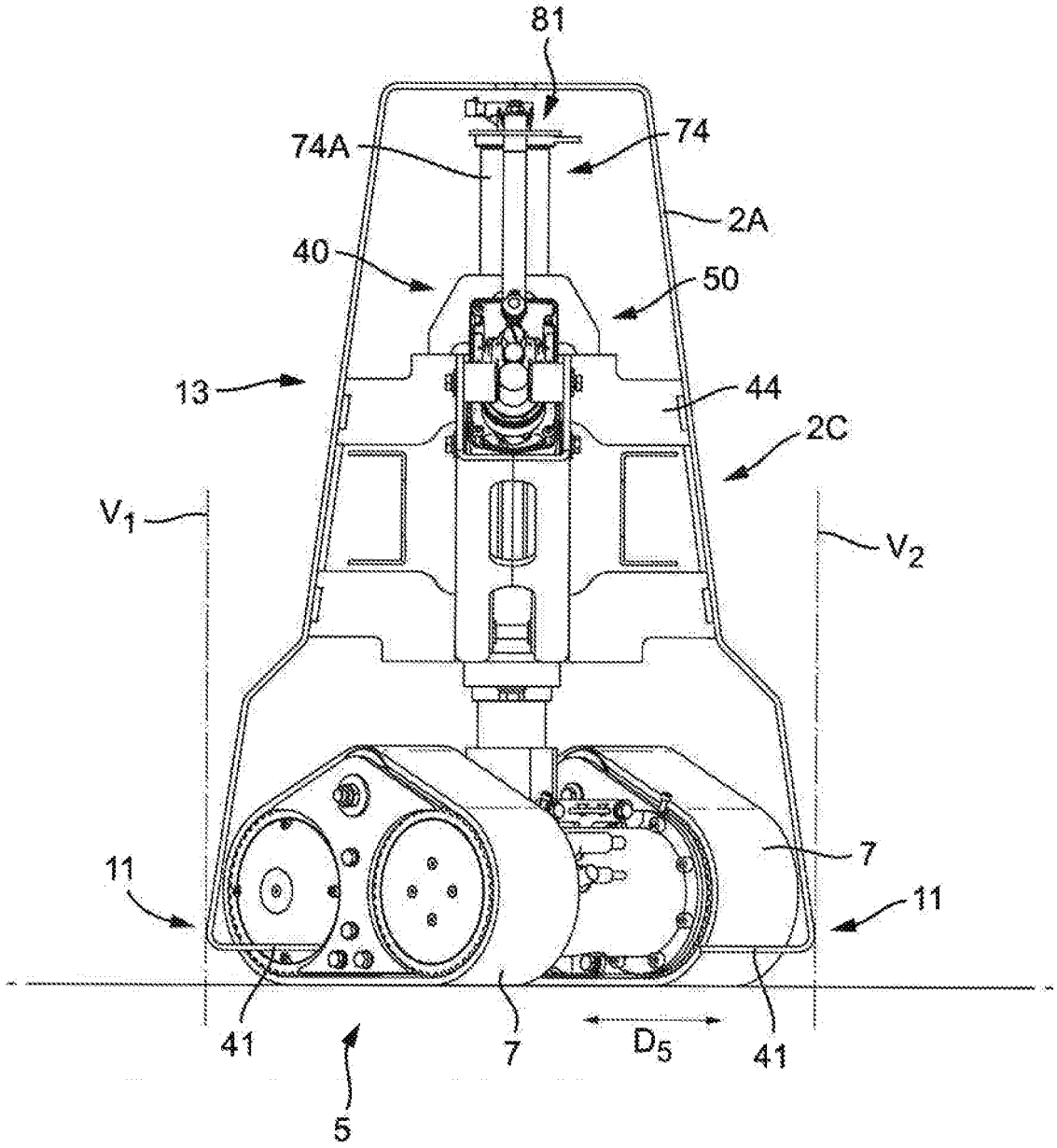


Fig. 7

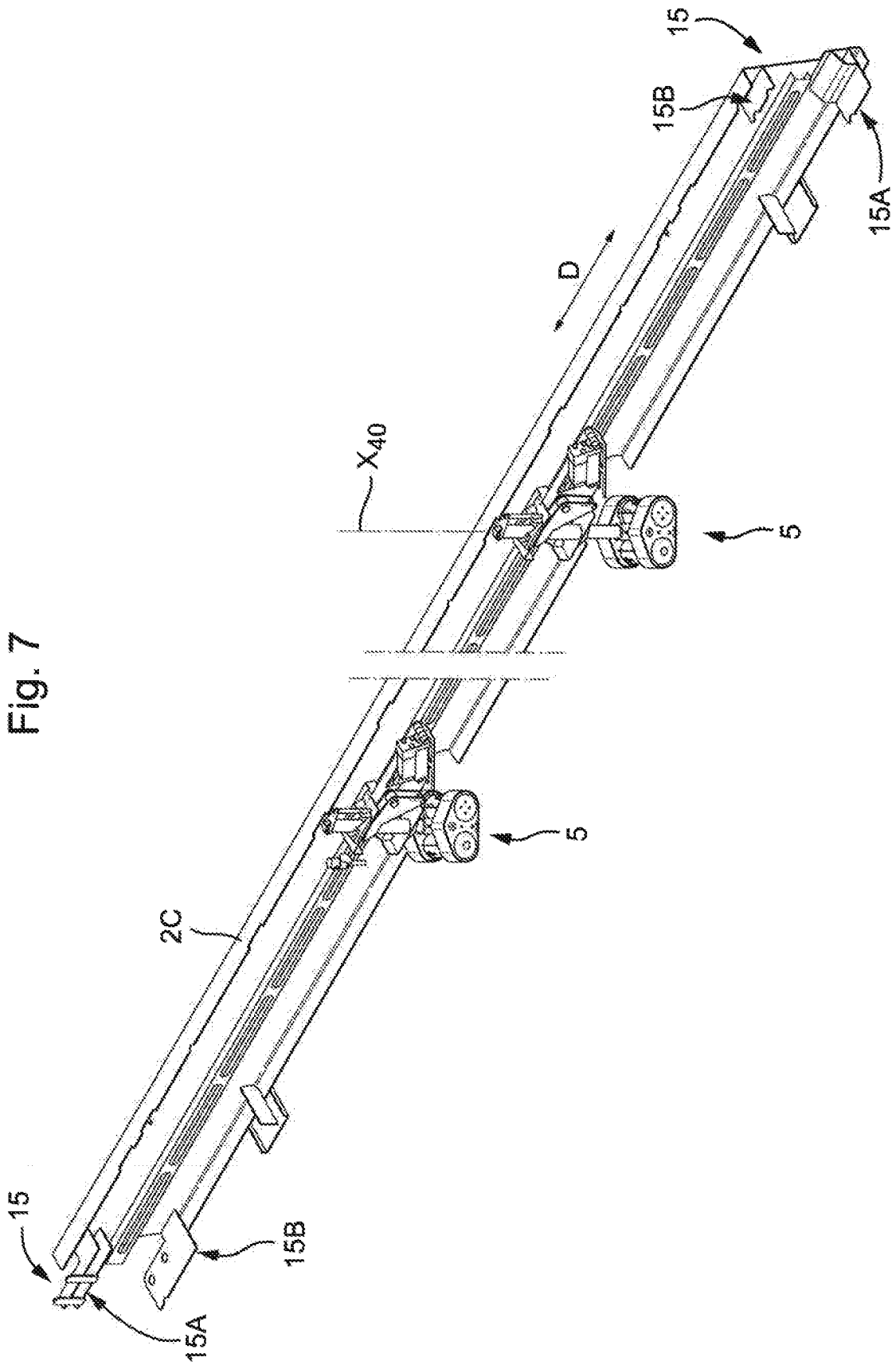
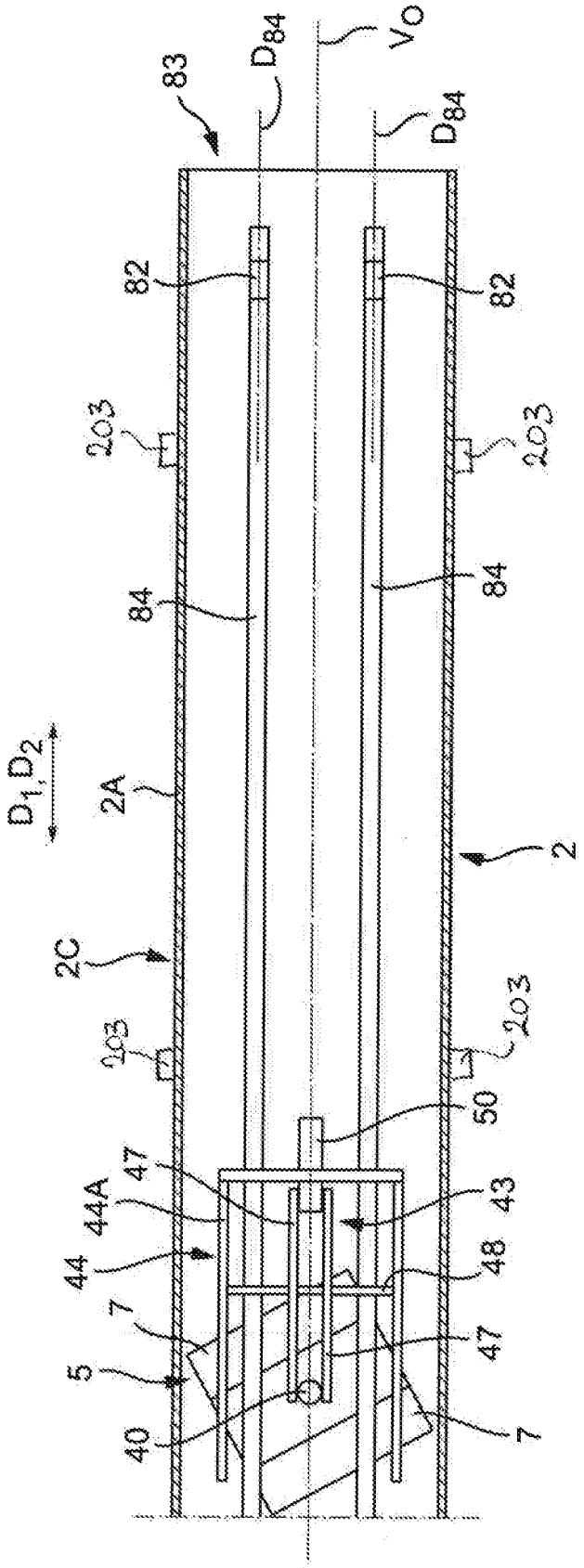


Fig. 7A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D84
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D84
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84
D1,D2
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2C
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203
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44A
43
44
48
7
47
5
7
40

Fig. 8A

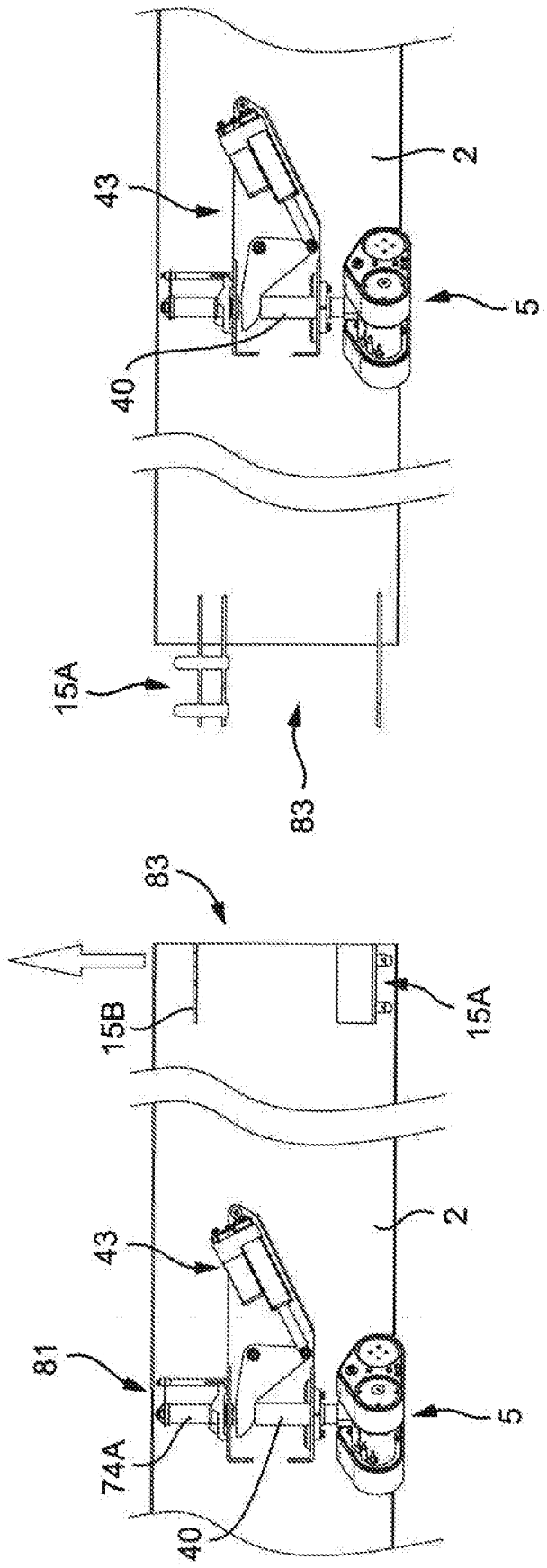


Fig. 8B

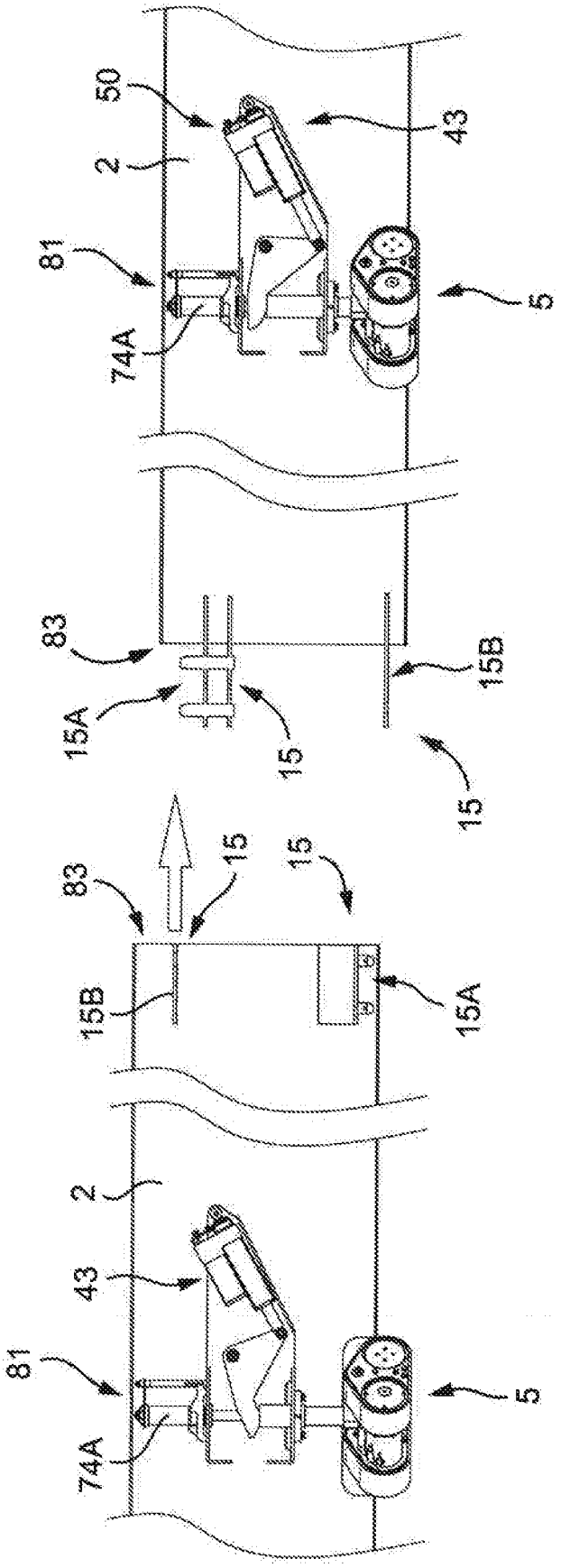
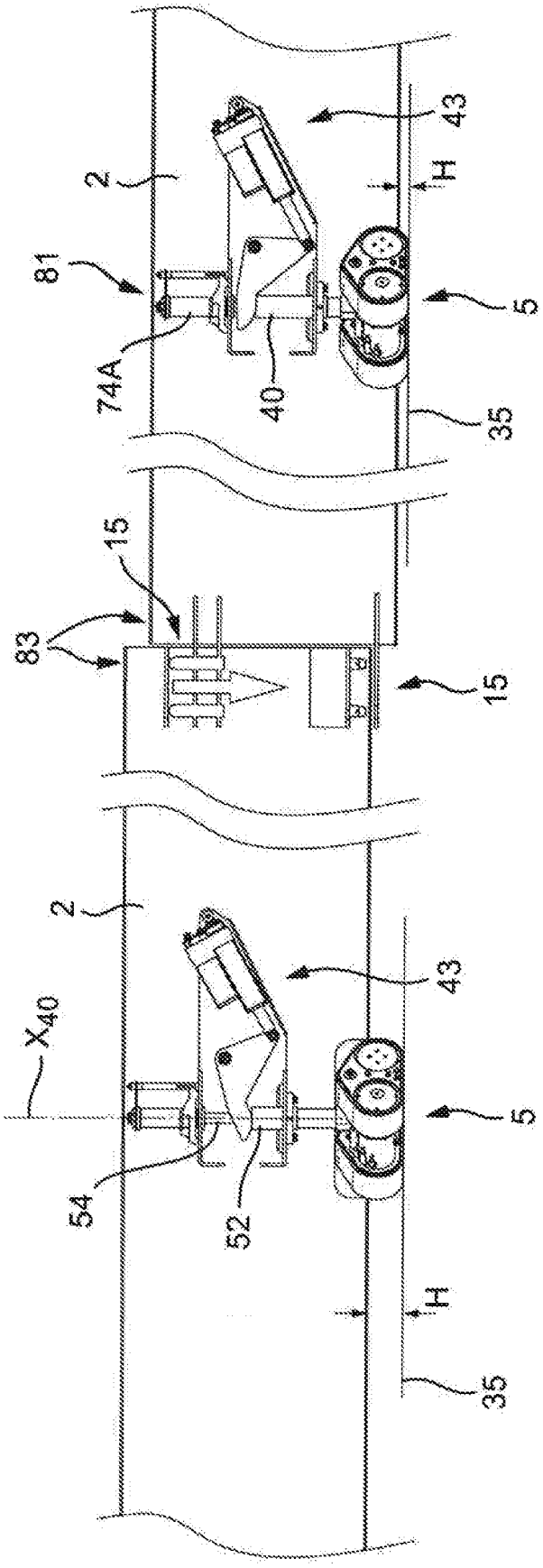


Fig. 8C



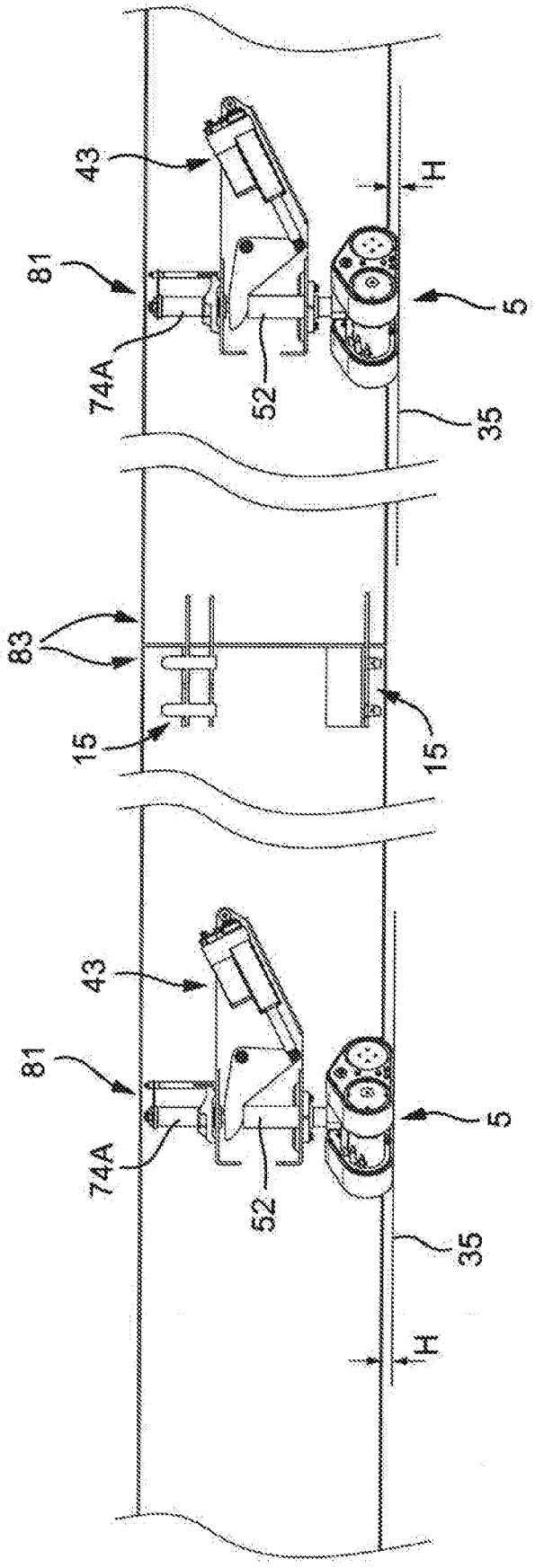
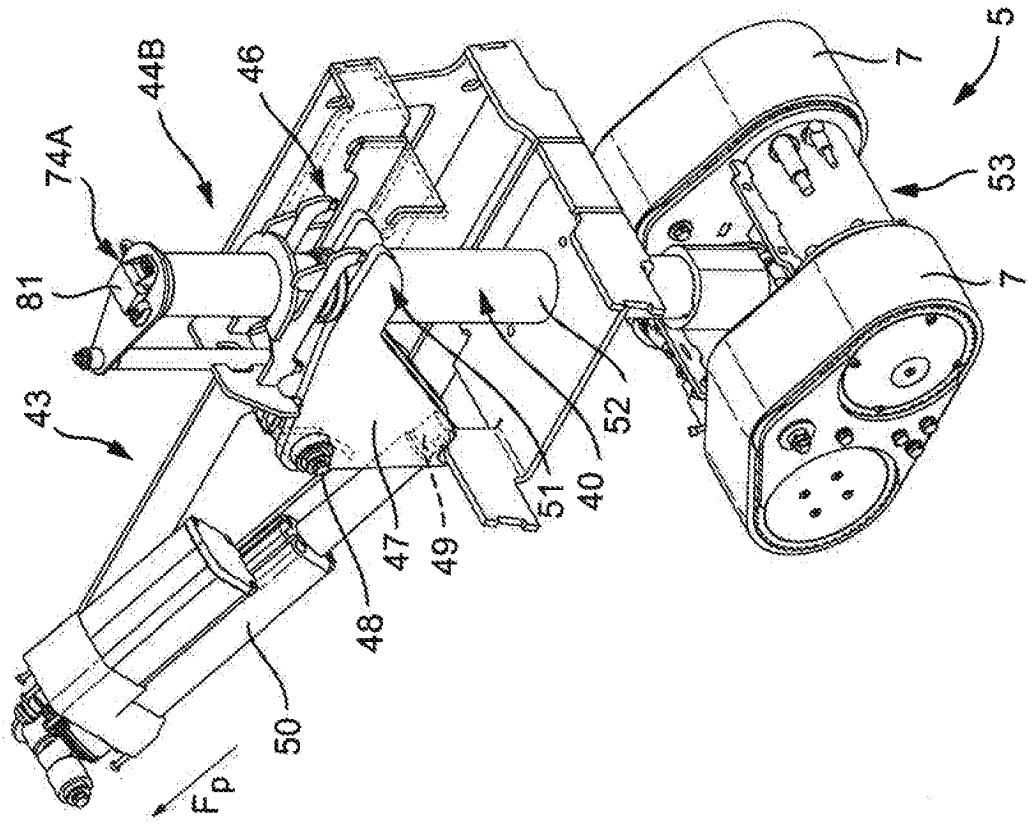


Fig. 8D

Fig. 10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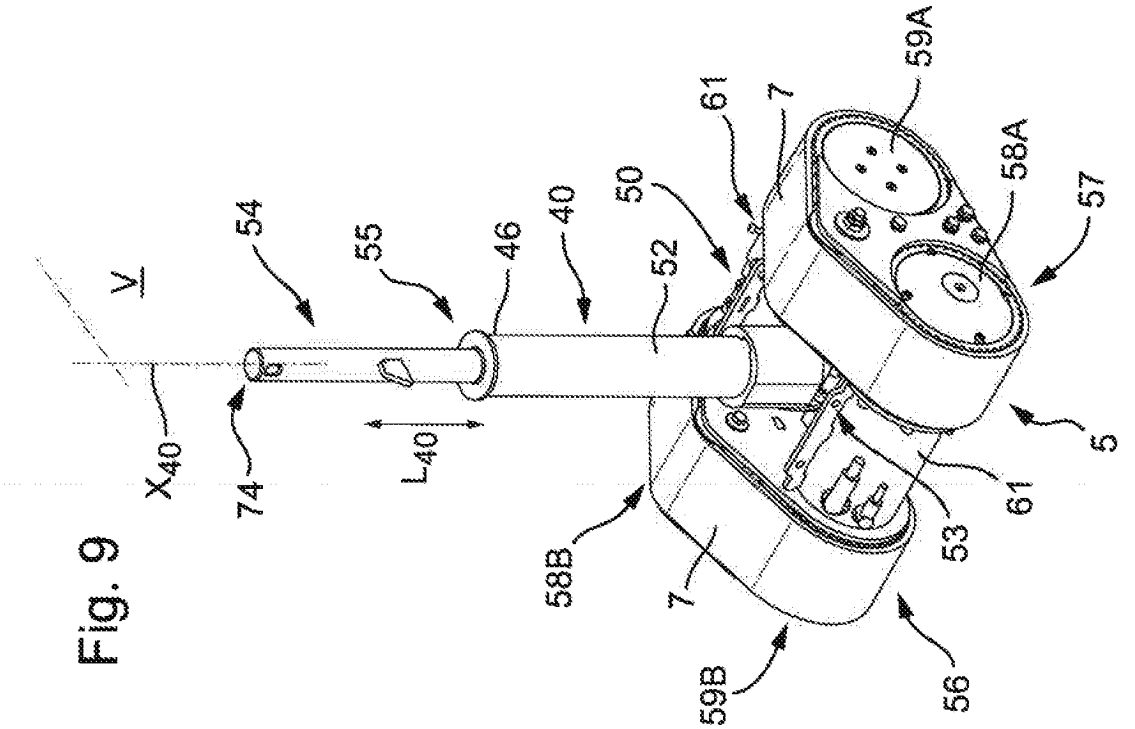
F_p

Fig. 9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X_{40}
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L_{40}
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58B
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59B
56
53
61

Fig. 11

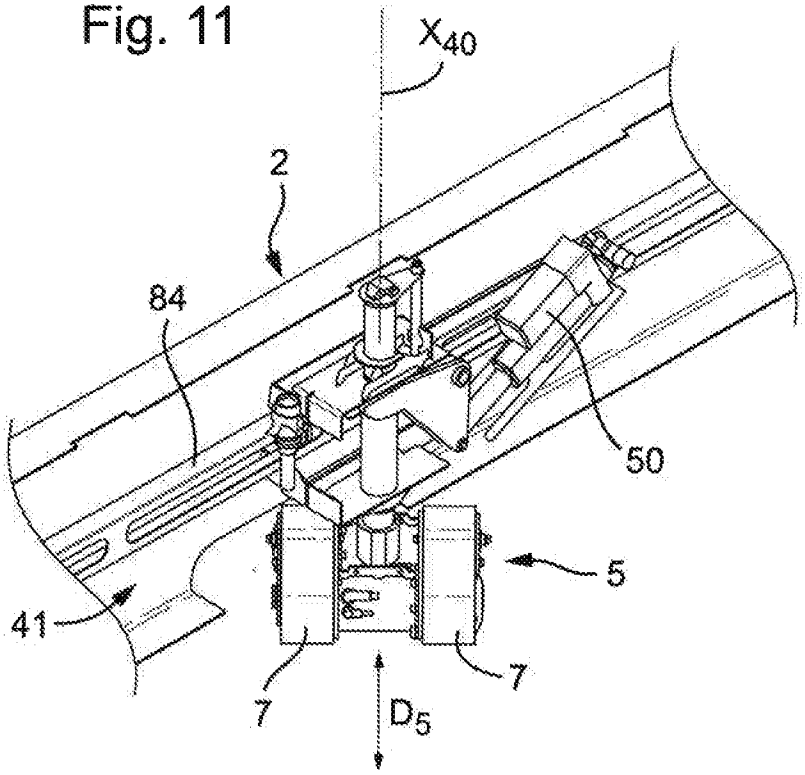


Fig. 12

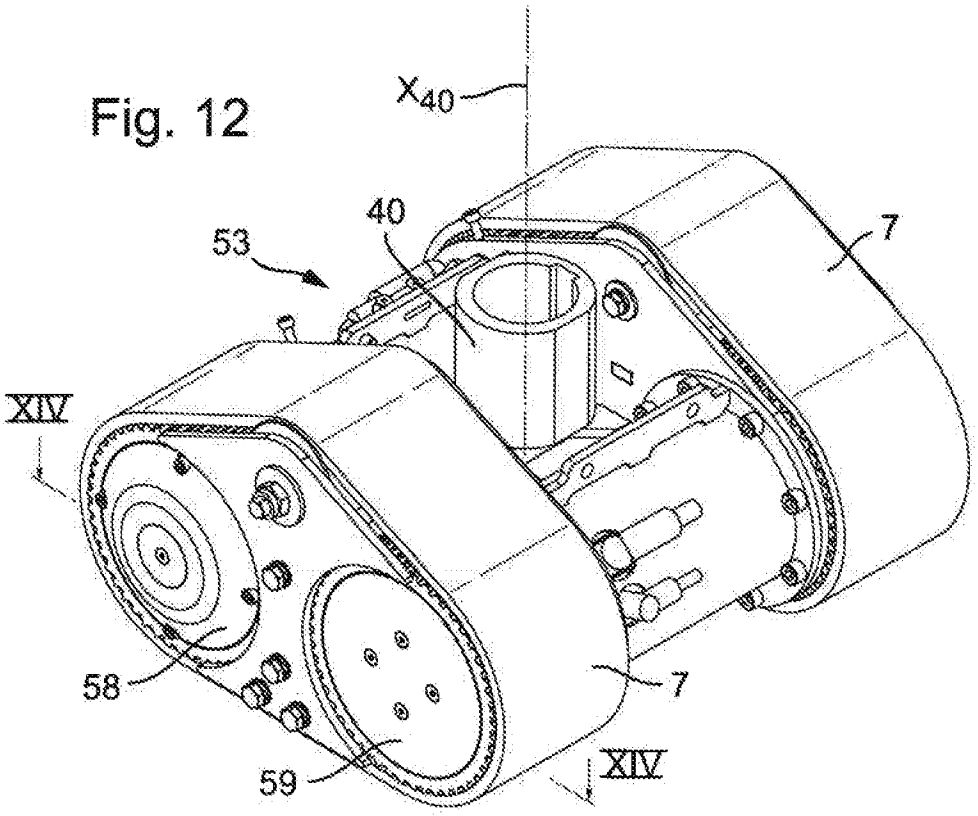


Fig. 13A

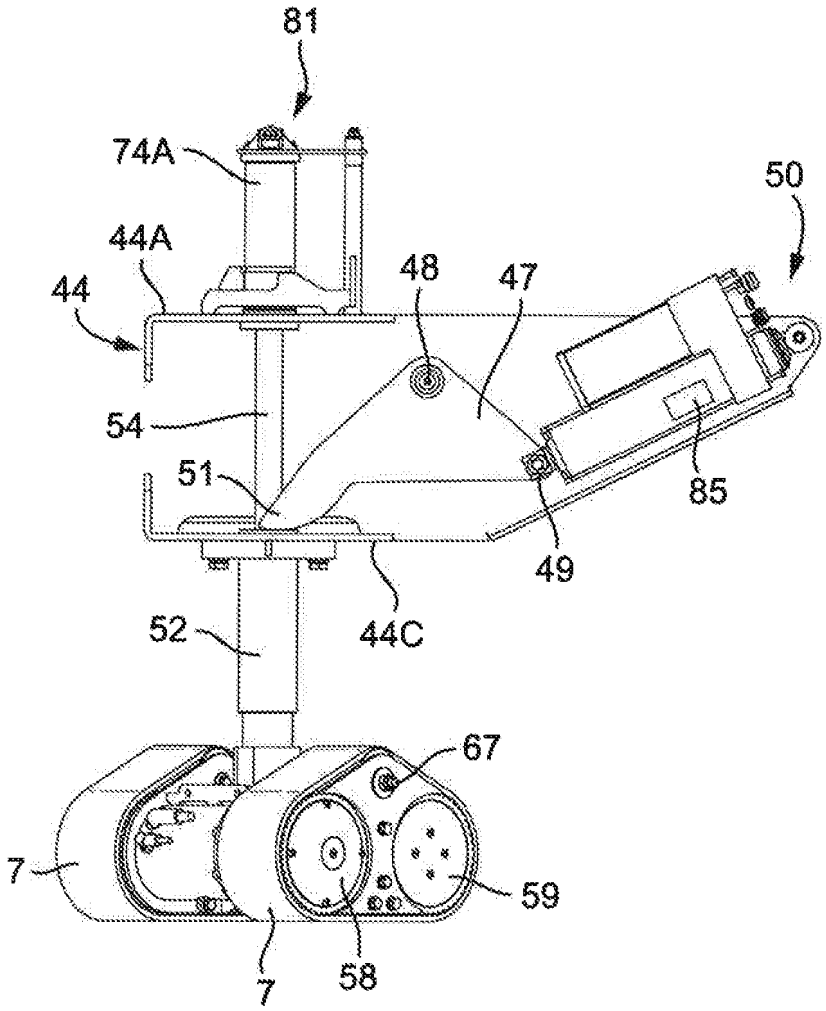


Fig. 13C

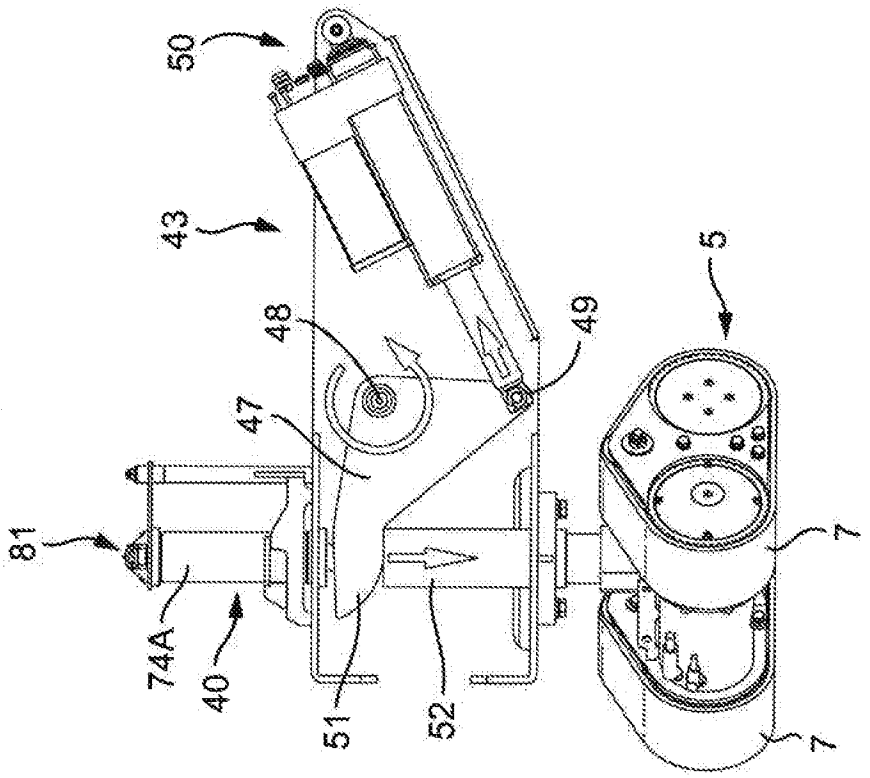


Fig. 13B

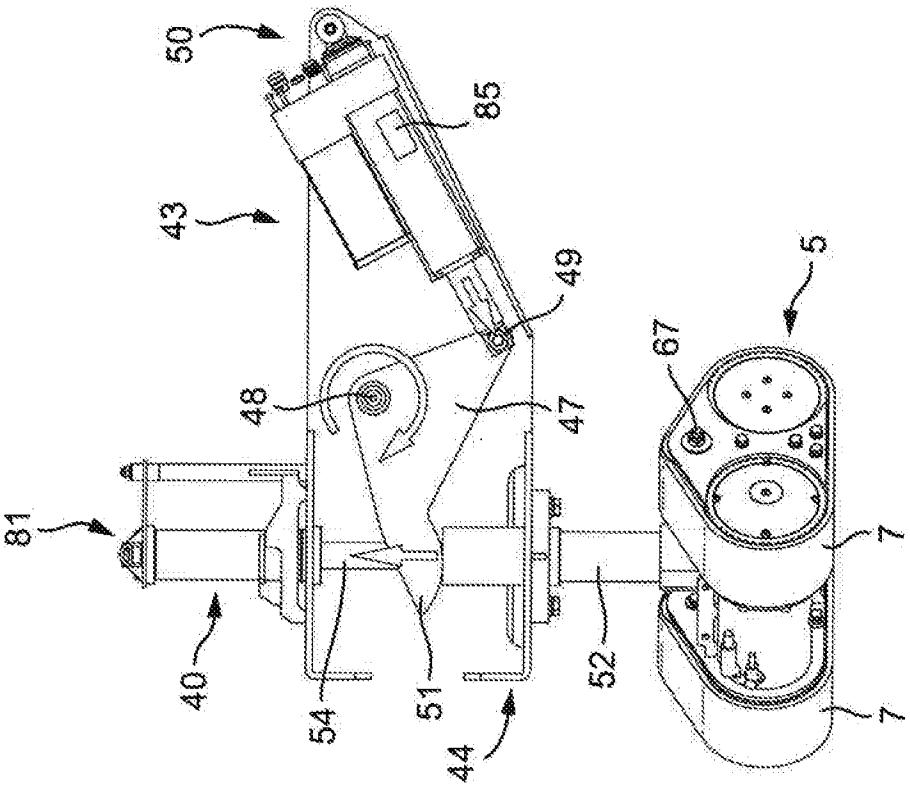
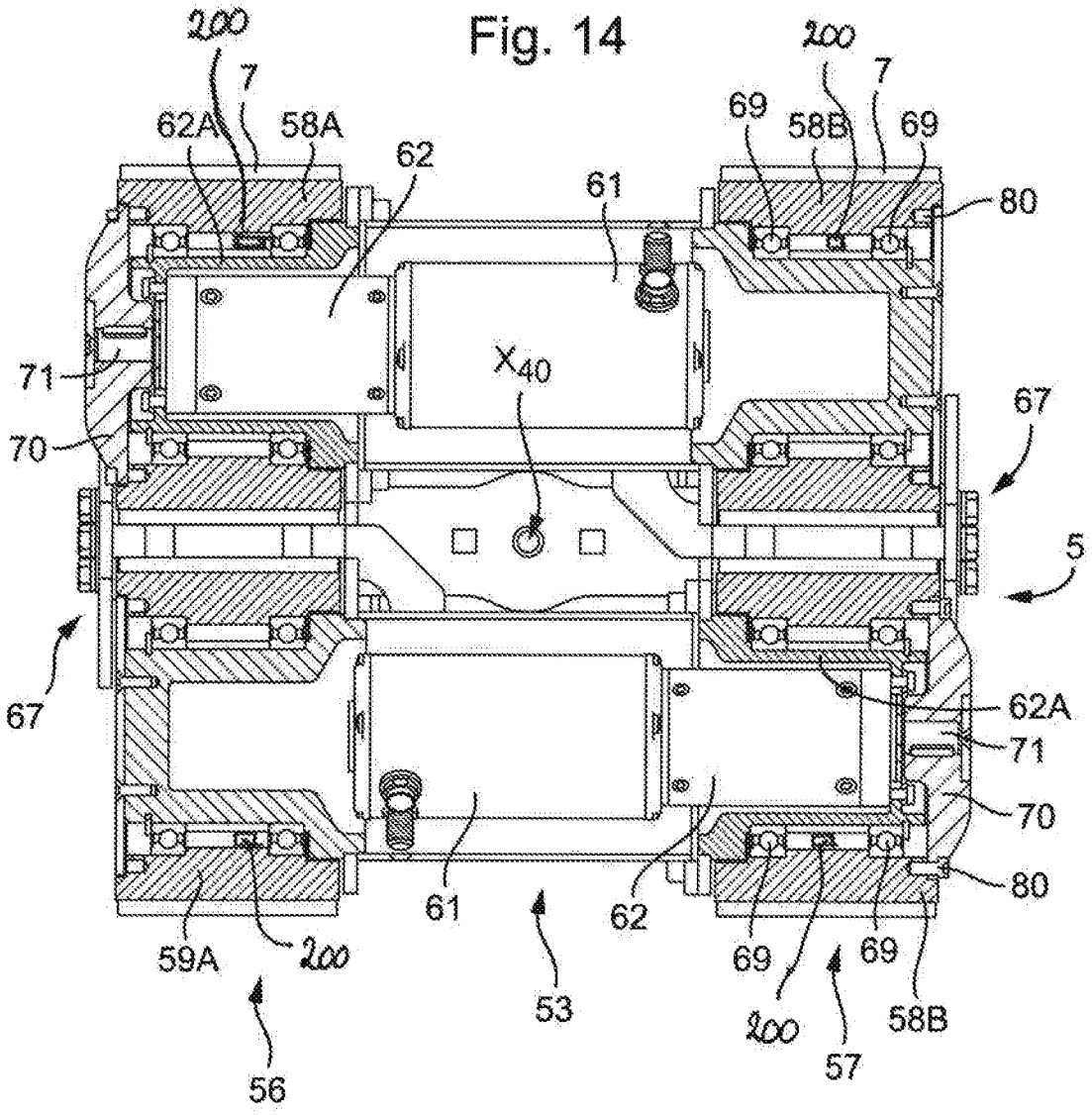


Fig. 14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X40
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59A
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62
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69
58B
53
200
57
56

Fig. 14A

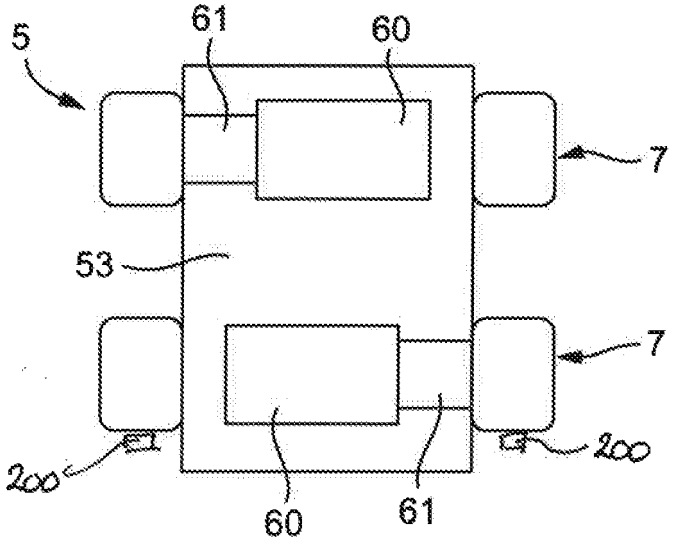


Fig. 14B

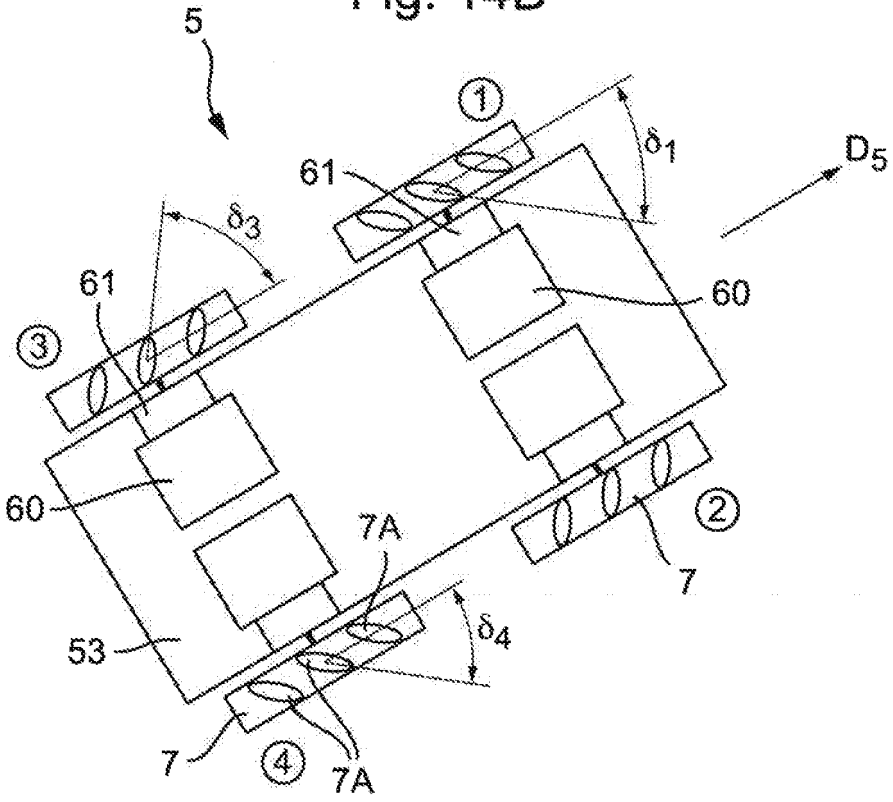


Fig. 15A

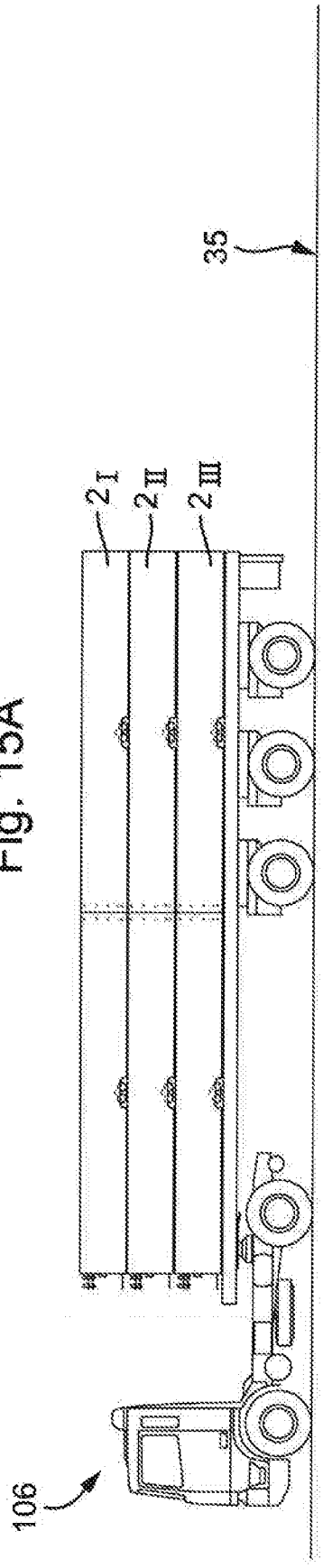
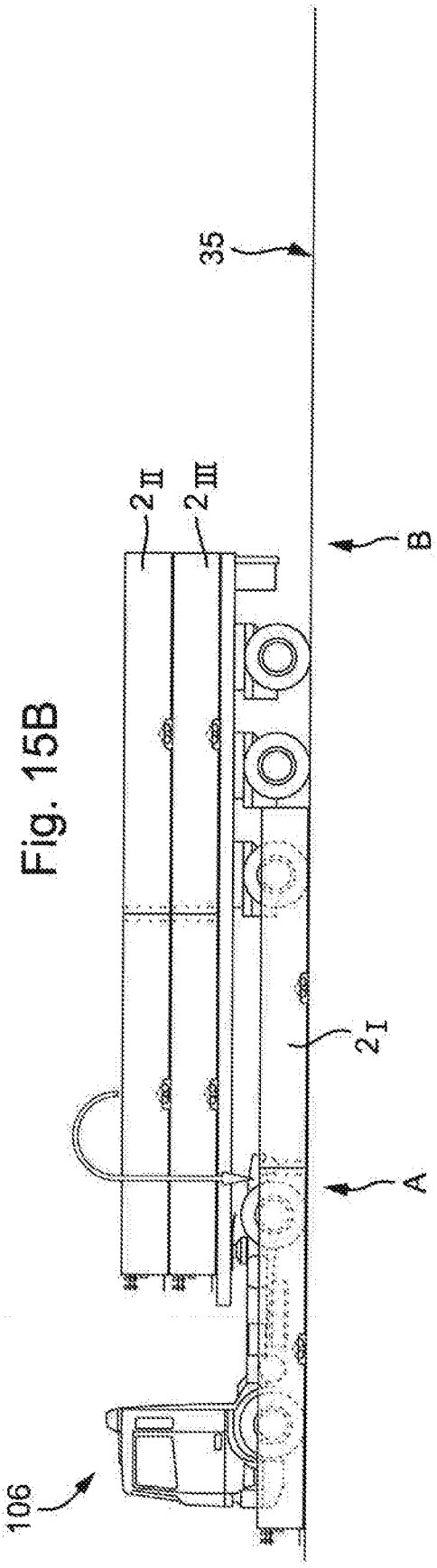


Fig. 15B



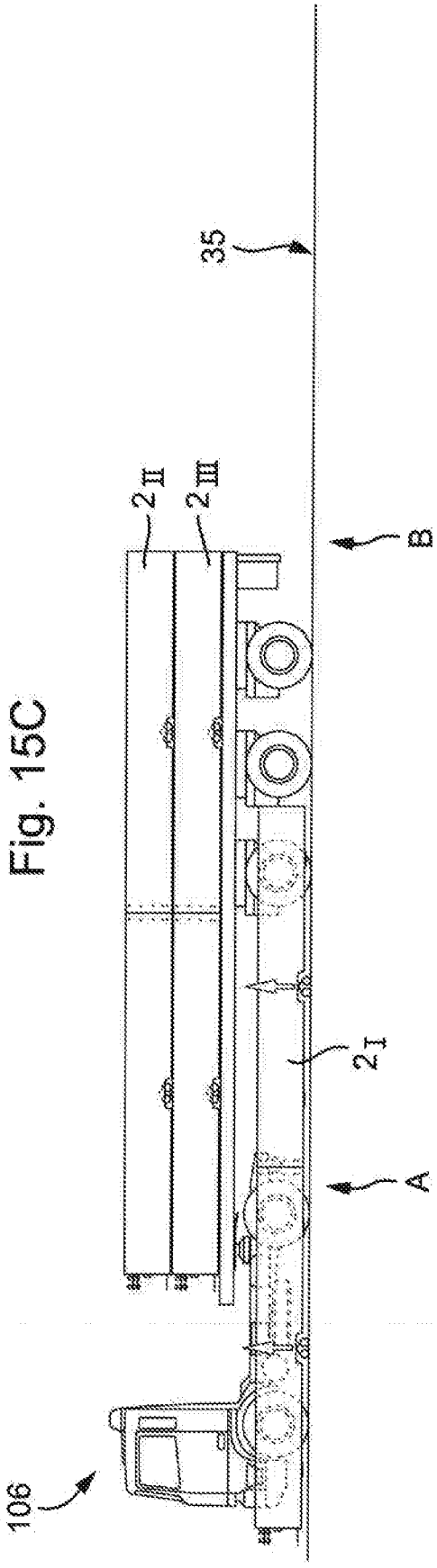


Fig. 15C

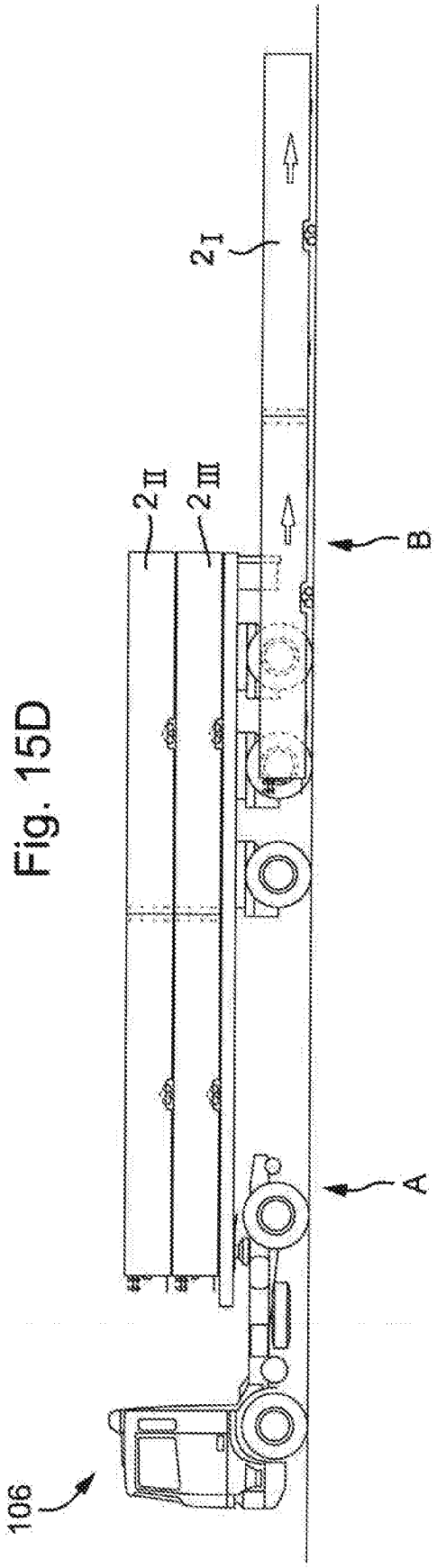


Fig. 15D

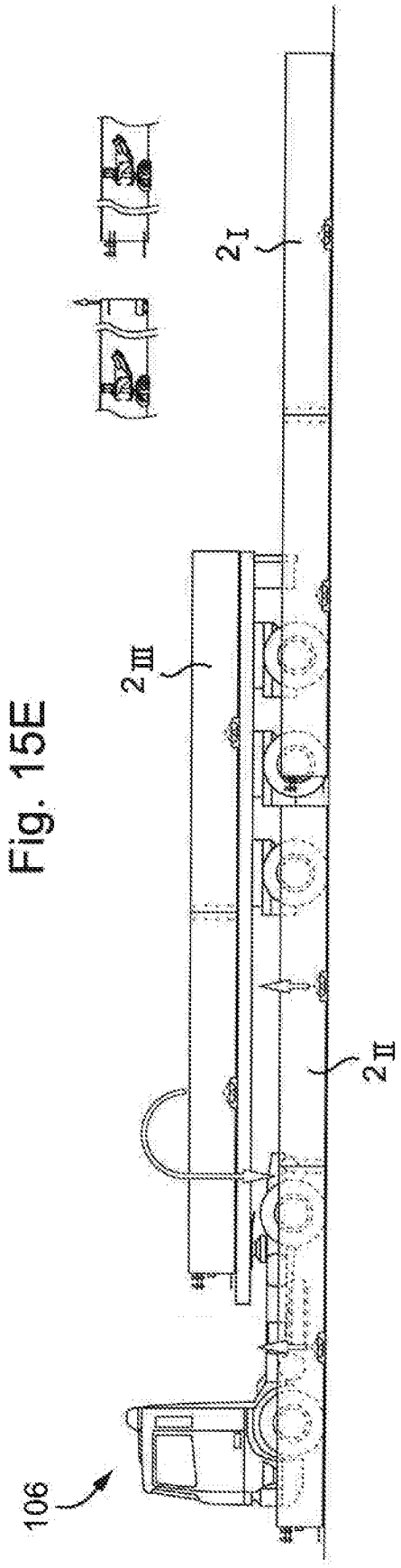


Fig. 15E

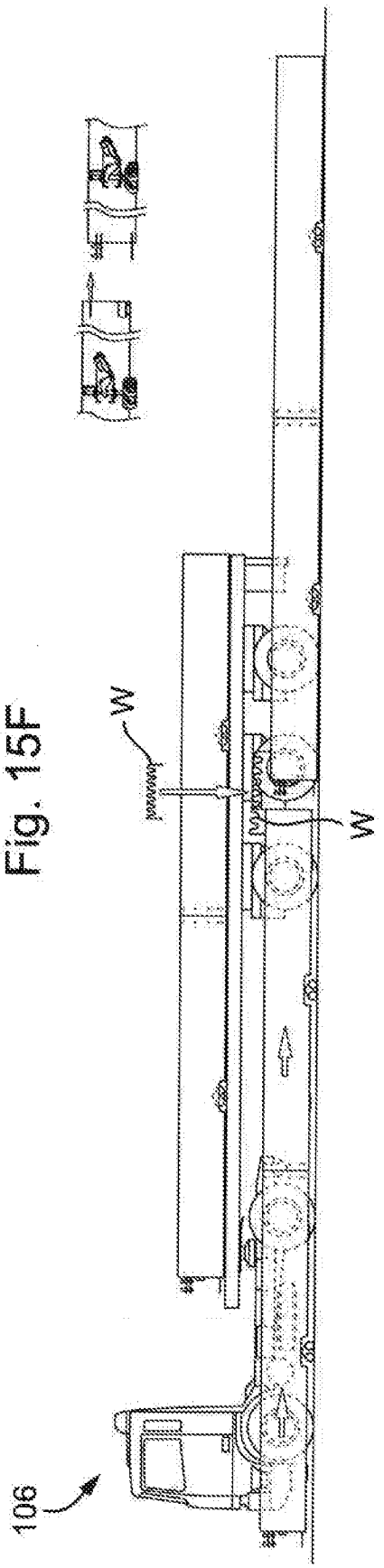


Fig. 15F

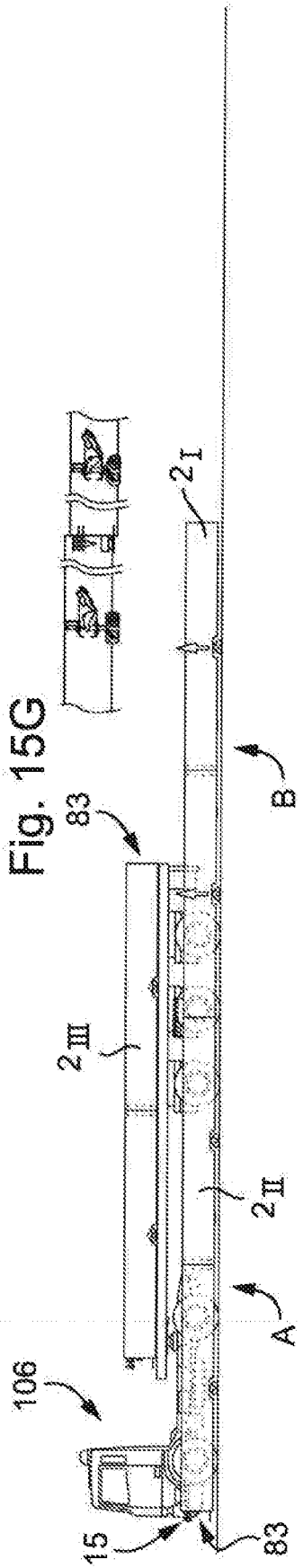


Fig. 15G
106
15
83
2III
2II
2I
A
B
83

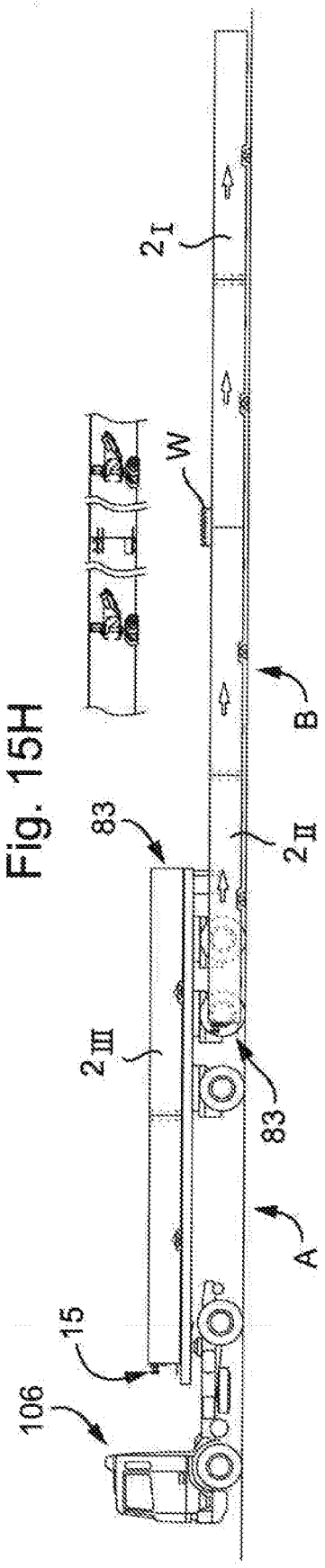


Fig. 15H
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2III
2II
2I
W
A
B
83

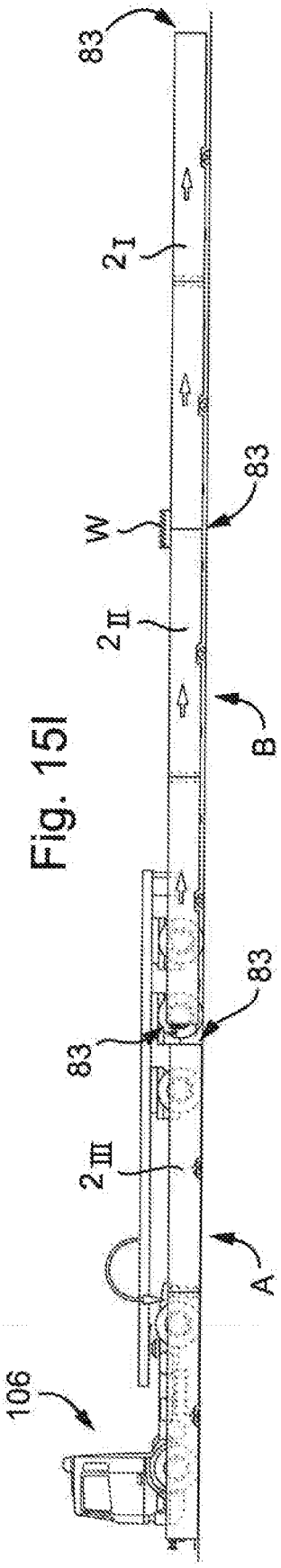
Fig. 15I
106
83
2III
2II
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W
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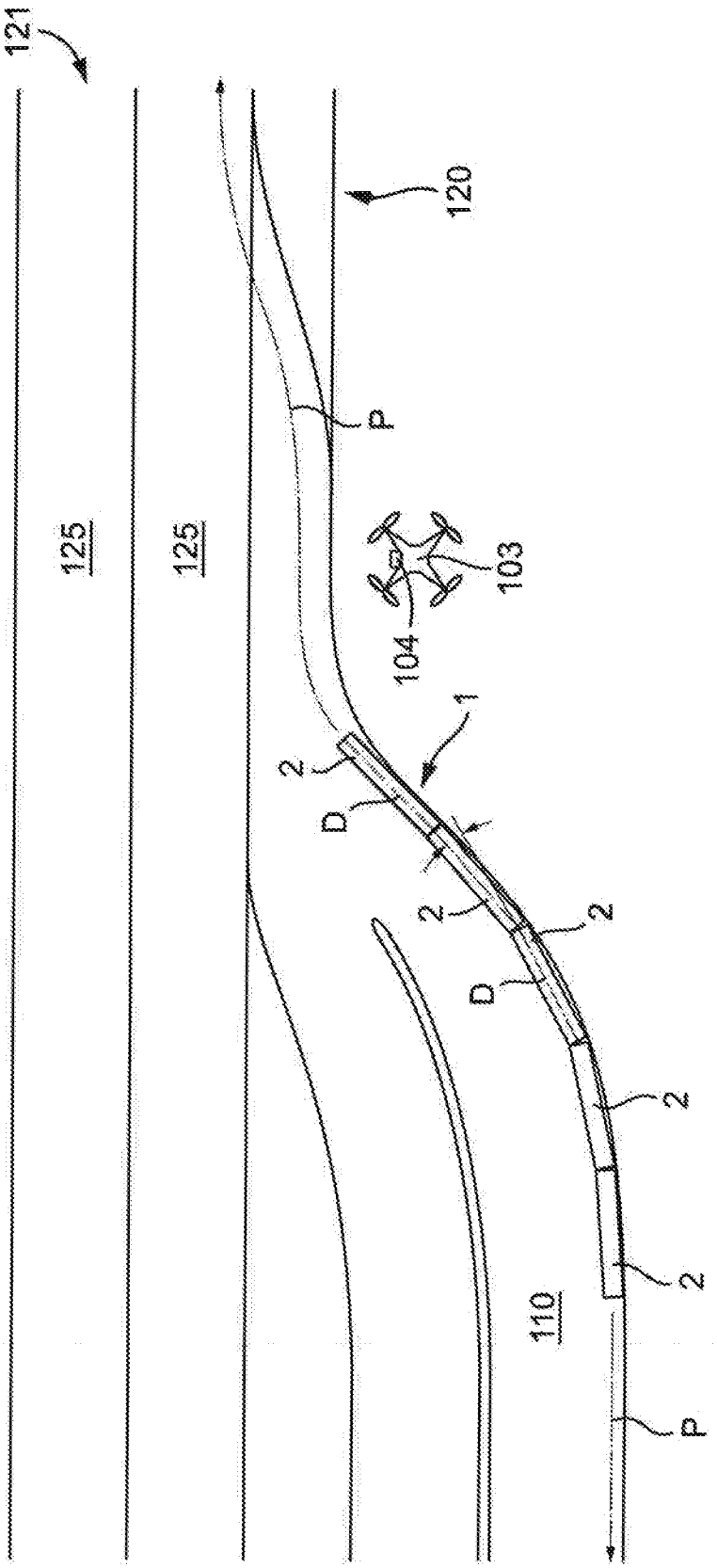
B
83
83

Fig. 16



REFERENCES CITED IN THE DESCRIPTION

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