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CONSTRUCTION VEHICLE WITH A BASE VEHICLE AND A BODY

Description

The invention relates to a construction vehicle according to the preamble of claim 1.

State of the art

A wide variety of construction vehicles are known under the designation of dumper or dump truck. Such a construction vehicle is described, for example, in the document EP 3 211 141 A2. The construction vehicle described therein is to be used as a special vehicle with so-called "articulated steering" only for use as a dumper or dump truck. Other construction vehicles are known, for example, from GB 1 489 113 A, DE 299 05 528 U1, DE 43 27 346 A1, or DE 31 38 824 A1.

In addition, dumpers with kingpin steering, skid steering, rear-wheel, front-wheel, or all-wheel steering are also known. Many trucks or so-called semi-trailers have a bed for tipping or unloading the construction material, some of which can also be interchanged.

GB 2 440 675 A discloses a so-called concrete mixer with an interchangeable concrete container, wherein the trailer or vehicle frame has a lifting/hoisting mechanism for changing the body, which mechanism comprises, among other things, a lifting cylinder or hydraulic cylinder.

For transporting the containers, they are secured to the trailer or vehicle frame. For this purpose, four manual locking mechanisms are available to securely lock the body, which mechanisms secure/lock/fix the container or its locking bolts on both sides of the vehicle frame or trailer as well as at the front and rear, in each case with a lock. Manual locking at four locations distributed around the vehicle is very time-consuming and cumbersome.

In addition, securing mechanisms for bodies with special actuating/lifting cylinders as well as, in some cases, various traction cables and return springs or the like have already become known in construction vehicles so that semi-manual operation can be achieved by means of an actuator. However, these securing and locking systems are structurally complex and prone to failure.

Object and advantages of the invention

In contrast, the object of the invention is to propose a construction vehicle with a base vehicle and a body which at least partially improves the disadvantages of the prior art, in particular is implemented with less effort and/or ensures safe operation or a safe mode of operation and/or enables novel functionalities.

Proceeding from a construction vehicle of the type mentioned at the outset, this object is achieved by the features of claim 1. Advantageous embodiments and developments of the invention are possible by the measures mentioned in the dependent claims.

Accordingly, a construction vehicle according to the invention is characterized in that the in particular linear drive unit designed as an unlocking/locking and/or tensioning unit is also designed as the lifting drive of the lifting device, wherein a rear vehicle-side coupling element (17) has a guide surface (18) extending downwards from the rear forwards, and a front vehicle-side coupling element (10) has an unlocking/locking and/or tensioning surface (13) extending downwards from the front rearwards, and/or that in a state of the interchangeable body (30) braced and/or locked to the base vehicle (1), a rear body-side coupling element (21) engages under the downwardly extending guide surface (18) of the rear vehicle-side coupling element (17), and a front body-side coupling element (16) engages under the downwardly extending unlocking/locking and/or tensioning surface (13) of the front vehicle-side coupling element (19).

Thus, according to the invention, by means of the drive unit, on the one hand at least an active lifting of the interchangeable body, and on the other hand at least an active unlocking or locking/tensioning, is provided or implemented. With the help of this dual function of the drive unit for unlocking/locking/tensioning and at the same time for lifting/lowering, a significant reduction in the design, financial and control technology outlay can be implemented.

In addition, operational reliability and susceptibility to failure are improved compared to the prior art by reducing the complexity of the overall system and the dual use of the drive unit.

The (active) unlocking or locking/tensioning of the unlocking/locking and/or tensioning unit is in stark contrast to many passive securing systems for securing or simply holding/positioning the interchangeable body. This means that in the prior art, simple mechanical stops and, in some cases, friction surface mounts are often provided which merely secure/position the interchangeable body, or prevent it from slipping forward when braking, by means of stops. In this case, a simple friction surface is often provided rearwards, i.e. when accelerating, i.e. the body only rests on the base vehicle/vehicle frame and, with its relatively high weight, generates a corresponding friction force that prevents slipping backwards at the relatively low accelerations that trucks etc. can usually achieve. In contrast, the manual locks disclosed in the document GB 2 440 675 A cited above are a real and secure mechanical locking, both frontwards, rearwards, and also upwards, i.e. against unintentional lifting, e.g. on uneven ground during travel.

Within the meaning of the invention, such a "real" or secure and mechanical locking, i.e. firm/secure fixing, of the interchangeable body can be actively implemented in an advantageous manner with the drive unit.

With the advantageous drive unit, a secure locking without play, inter alia, can also be achieved. This means that in a clamped or locked state, there is no space, air gap or tolerance between the two locking components of the base vehicle and the interchangeable body. This effectively prevents the locking mechanism from “working loose” or “knocking out”, even in the event of wear or abrasion. Accordingly, a firm, wobble-free fixing of the interchangeable body is achieved even over long periods of time or even in the event of wear or abrasion. This is particularly important given the large forces and weights of such bodies on construction vehicles, particularly for operational safety and/or service life. The manual locks or return springs according to the above-mentioned prior art either necessarily have a certain amount of play in order to be able to manually insert the latch into the holder and/or have only low holding forces, e.g. only the return spring force, possibly plus friction forces.

The base vehicle has a vehicle-side coupling unit for coupling and uncoupling the interchangeable body, wherein an interchangeable body is also provided which comprises one or more body-side coupling elements for coupling the

interchangeable body to the base vehicle. The base vehicle can therefore be used without a body or with a different body. This allows for more flexible use of the base vehicle for functionally different bodies, e.g. tippable beds, so-called three-way tippers, skip loaders, water or liquid tanks, pressure tanks, open or (partially) closed platforms/bodies and/or concrete mixers, etc. According to the invention, different bed structures can also be used flexibly. In addition, a defective body or a defective base vehicle can be quickly interchanged.

Advantageously, the base vehicle has the drive unit and at least one vehicle-side and/or body-side coupling element, the position of which can be changed by the drive unit. With such a drive unit, coupling and uncoupling or securely locking the body can be accomplished more easily by adjusting the coupling element on the vehicle side and/or the body side.

In a particular development of the invention, it is provided that the drive unit is a linear drive unit, in particular a hydraulic lifting cylinder, and/or that a distance of least two coupling elements from each other can be changed by the drive unit. With two coupling elements arranged at a distance from each other, a more stable anchoring of the body to the base vehicle is possible, which is particularly advantageous if, for example, the body has a tilting function and the body therefore has to be held on the base vehicle in different states of load.

By adjusting the distance between the two coupling elements, they can be actuated with a common drive element. In addition, it is thereby also possible to lock/brace the body as explained below. With a bracing, a play-free fastening can in turn be achieved, which can also be independent of the wear of the coupling elements.

If one adjustment and/or drive direction of the linear drive unit and/or the first vehicle-side coupling element is aligned parallel to the longitudinal direction and/or direction of travel of the base vehicle, in particular when driving straight ahead, i.e. in the longitudinal direction of the base vehicle, vehicle-side and/or body-side coupling elements arranged at a distance from one another in the longitudinal direction must also be accordingly actuated. This allows a good, secure, and play-free fastening of the body against load changes in the longitudinal direction, in particular in the event of wear or abrasion of the coupling elements. Such load

changes occur not only during travel, but also for example in a bed body when the bed is tipped backwards.

Advantageously, the lifting device comprises at least one engagement element having a contact surface for arranging on the interchangeable body and/or for lifting the interchangeable body in a lifting position, wherein in particular the center of gravity of the interchangeable body is arranged at least in the lifting position between the contact surface of the engagement element and the first axis of rotation, and/or the lifting device in the lifting position for lifting the interchangeable body engages this interchangeable body with an engagement element arranged in front of the center of gravity of the interchangeable body in relation to the first direction of travel, in particular the forward direction of travel, with a driver unit and/or driver's cab arranged in front of the body.

In order to drive the base vehicle out from under an uncoupled interchangeable body, the interchangeable body should be lifted relative to the base vehicle. For this purpose, the base vehicle must be equipped with a lifting device with a lifting drive for lifting the interchangeable body. Thus, the interchangeable body can be placed in an elevated position, e.g. on at least two or three, in particular four supports or the like, by means of the vehicle-side lifting device so that the base vehicle can then advantageously be driven out from under the interchangeable body.

Where applicable, the tilting axis of the interchangeable body and/or the bed is also the first axis of rotation of the interchangeable body or the bed. This advantageously realizes or provides a dual function of the first axis of rotation, namely for tilting and for interchanging. This also supports the dual function of the drive unit. This allows implementation to be realized with minimal construction effort and at a low cost.

Therefore, it is sufficient and easier to lift the interchangeable body at an angle on one side in comparison to a vertical lifting movement of the interchangeable body. This can be achieved, for example, by the lifting device advantageously engaging the interchangeable body in the lifting position for lifting the interchangeable body with an engagement element arranged in front of the center of gravity of the interchangeable body, relative to the forward travel direction. Due to this

arrangement of the engagement point, the interchangeable body will be lifted at an angle at its front when actuating the lifting device so that the vehicle can then advantageously drive out (forwards) from under the interchangeable body.

To uncouple and put down the interchangeable body, at least two rear supports can be installed before lifting, for example, on which the interchangeable body is supported at the front during lifting. Supports can then also be installed further forward or at a distance from the rear supports, for example at least two front supports, on which the interchangeable body then rests when the lifting device is lowered, wherein a small distance to the chassis of the base vehicle is left, and said vehicle can drive out from under the interchangeable body.

The lifting device uses the linear drive unit provided as a unlocking/locking and/or clamping unit in an advantageous embodiment so that no separate drive is required for the lifting device. The linear drive for unlocking/locking and/or tensioning the coupling elements is accordingly also the lifting drive of the lifting device.

In an advantageous variant of the invention, the lifting device comprises a lever arrangement, in particular a knee lever, wherein in particular the lever arrangement and/or the knee lever has at least the contact surface and/or the engagement element. In order to derive, for example, a different/differently oriented adjustment and/or at least partially vertically oriented transverse movement or lifting movement from the substantially horizontal and/or linear movement of the drive according to the invention, the lifting device designed in a particular embodiment is provided with the lever arrangement which can in particular comprise the knee lever. At the same time, with corresponding dimensioning and arrangement, a force transmission can also be realized in an advantageous manner with the knee lever since, depending on the design, the force requirements for the lifting device can differ from those for the tensioning/locking of the coupling elements.

As an alternative to the lifting device described above, the lifting device could also be implemented independently of the drive of the coupling elements, for example in the form of a height-adjustable chassis or one or more separate lifting cylinders on the interchangeable body or the base vehicle.

Advantageously, at least a first drive phase of the drive unit, which is designed in particular as a lifting drive, is designed as an unlocking/locking and/or tensioning phase, and in addition a second drive phase of the drive unit, which is designed in particular as a lifting drive, is designed as a lifting or lowering phase of the lifting device. This makes it possible to advantageously achieve a mechanical and/or temporal decoupling or temporally staggered operation of the different operating or drive phases, in particular with the common drive or the common drive unit.

In an advantageous development of the invention, a freewheel is provided over a freewheel section, in particular in the form of a slotted guide with a stop element connected to the lever arrangement. The freewheel section here should be greater than or equal to the change in distance provided for bracing and/or locking between two coupling elements provided for bracing and/or locking the interchangeable body. The use of such a freewheel enables the coupling elements to be unlocked/locked and/or tensioned and relaxed without being influenced by the lifting device. This actuation of the coupling elements can be carried out while the lifting device is in the freewheel mode of the drive device.

For example, the coupling elements can be connected directly to the drive, in particular to a lifting cylinder, while the lifting device is moved, for example, via a driver element/bolt sliding in a slotted guide and remains in the rest position until the driver element/bolt strikes an end stop of the slotted guide. At this point, the interchangeable body is already unlocked or relaxed so that it can be lifted easily while the distance between the coupling elements is further reduced. In the opposite direction, the interchangeable body is lowered while the coupling elements move apart at the same time, but the tensioning/locking does not begin until the interchangeable body has reached its lowest position and the lifting device goes into freewheel mode.

In an advantageous design of the coupling unit, at least one of the vehicle-side and/or body-side coupling elements has an unlocking/locking and/or clamping surface running obliquely relative to the longitudinal axis and/or direction of travel of the base vehicle. With such obliquely extending unlocking/locking and/or clamping surfaces, with the aid of a linear thrust, unlocking/locking and/or clamping forces can be generated which are directed obliquely or orthogonally to the thrust direction. With

such a coupling element, a body can therefore be clamped to the chassis of the base vehicle. Such a design has the further advantage that if the unlocking/locking and/or clamping surface or the component adjacent thereto becomes worn, the desired locking/clamping force is maintained by a clamping/pressure in the thrust direction. Such a coupling element can for example be designed as a linearly displaceable unlocking/locking and/or clamping wedge.

Construction vehicles usually have a preferred so-called forward driving mode and a so-called reverse driving mode. In so-called forward driving, the driver's cab or the driver is usually arranged in front of the body or the tipping unit, and in so-called backward driving, the driver's cab or the driver is usually arranged behind the body or the tipping unit. The same also applies to the so-called rear of the vehicle and the corresponding so-called front of the vehicle.

However, the construction vehicle, in particular a dumper or the like, can advantageously have a driver's console or driver's cab that can in particular be rotated about a substantially vertically aligned axis of rotation so that the driver can look "forward" in both directions of travel, and there are no fixed, so-called "forward/backward directions" or "front/back sides." Within the meaning of the invention, the vehicle drives "forward" in two different ways, one in which the body is arranged behind the driver or the driver's cab in relation to the direction of travel, and one in which the body is arranged in front of the driver or the driver's cab in relation to the direction of travel.

In the following, however, so-called backward travel within the meaning of the invention is to be understood as the travel or direction of travel in which the body is arranged in front of the base vehicle or the driver unit. Accordingly, so-called forward travel within the meaning of the invention is to be understood as the travel or direction of travel in which the body is arranged behind the base vehicle or the driver unit. In addition, within the meaning of the invention, the so-called rear side is intended to designate the side of the vehicle which is oriented/exposed to the rear or opposite the forward direction of travel during the aforementioned so-called forward travel. In this sense, the front side faces forward during the aforementioned so-called forward travel.

Furthermore, it is advantageous if a vehicle-side coupling element has a receiving opening directed towards a side facing away from the driver unit and/or the driver's cab, in particular towards a rear side, of the base vehicle for receiving at least one body-side coupling element. This means that when the base vehicle is traveling backwards, a mating body-side coupling element can be received by this vehicle-side coupling element.

If the vehicle-side coupling element with receiving opening has two guide surfaces extending obliquely towards each other in a first travel direction, in particular a forward travel direction with a driver unit and/or driver's cab arranged in front of the body, a V-shaped guide is formed in which the mating body-side coupling element is guided into its end position. At the same time, at least one of these guide surfaces can be provided as a locking/unlocking and/or clamping surface in order to lock/clamp the interchangeable body to the base vehicle, e.g. to its chassis, via the coupling element on the body.

Such a locking/tensioning can be achieved, for example, with a single linear drive if a rear vehicle-side coupling element has a guide surface extending downwards from the rear forwards, and a front vehicle-side coupling element has an unlocking/locking and/or tensioning surface extending downwards from the front rearwards. This means that two vehicle-side coupling elements in the contracted position can be brought under two body-side coupling elements which are firmly attached to the interchangeable body, and can reach under these in a pushed-apart position, and thereby mutually clamp/lock the vehicle-side and body-side coupling elements.

In this state of the interchangeable body clamped/locked to the base vehicle, a rear coupling element on the body side thus engages under the downward-extending guide surface of the rear coupling element on the vehicle side, and a front coupling element on the body side engages under the downward-extending unlocking/locking and/or clamping surface of the front coupling element on the vehicle side.

Advantageously, at least one second axis of rotation is provided, about which the interchangeable body can be rotated with a second radius during the coupling and/or uncoupling phase, wherein the interchangeable body can be rotated about

the first axis of rotation in a first rotation phase and about the second axis of rotation in a second rotation phase. In this case, the first radius of the first axis of rotation is preferably different, in particular smaller, than the second radius of the second axis of rotation.

Thus, during the coupling and/or uncoupling phase, the interchangeable body can advantageously be rotated about the first axis of rotation with a first radius, wherein in a second rotation phase, the interchangeable body advantageously rotates about the second axis of rotation, wherein in particular the first radius of the first axis of rotation is designed smaller than the second radius of the second axis of rotation, and/or wherein the first axis of rotation is designed as an unlocking/locking and/or clamping element of the unlocking/locking and/or clamping unit, and/or wherein the second axis of rotation is designed as a support element of the interchangeable body.

In an advantageous variant of the invention, the first axis of rotation is designed as a bolt element of the interchangeable body and/or as a unlocking or locking and/or clamping element of the unlocking/locking and/or clamping unit, and/or the second axis of rotation is designed as a support element of the interchangeable body. This results in an improvement in terms of design, process and cost savings. Advantageously, an optionally provided length adjustment unit of the second axis of rotation of the support element, in particular with a fixing option/element, can also be used either manually and/or semi-automatically/automatically. This allows an advantageous adaptation of the length of the support element to uneven ground or the like.

In order to ensure that the interchangeable body is reliably fixed to the base vehicle, a sensor unit, in particular in the form of a mechanical button movable by a coupling element on the body, can be provided for monitoring to detect a coupled interchangeable body.

Such a sensor unit can also be used advantageously to equip the control unit of the base vehicle with a security system. For example, the base vehicle can have a control unit for controlling the driving speed depending on the type of coupled

interchangeable body. It is also possible to control the driving speed depending on whether an interchangeable body is coupled or not.

To facilitate operation when picking up and putting down the interchangeable body, it is advantageous if a control element arranged outside the driver unit is provided for operating the unlocking/locking and/or tensioning unit.

Furthermore, it is advantageous if the control unit has at least two operating modes that can be selected by the operator, e.g. a driving mode and a changeover mode, wherein in the driving mode, an activation of at least one driving function, such as the automatic re-tensioning of the unlocking/locking and/or tensioning unit and/or the control of the driving speed is provided. In the changeover mode, a deactivation of such a driving function and/or an activation of a changeover function, such as the release of the control element arranged outside the driver unit, can be provided.

In an advantageous variant of the invention, it is for example provided as a safety function that the construction machine or the base vehicle can advantageously drive only when the unlocking/locking and/or clamping unit or the drive unit/hydraulic cylinder is controlled, i.e. in particular is subjected to clamping energy/force or pressure. The unlocking/locking and/or clamping unit is advantageously permanently clamped or subjected to pressure/clamping energy during operation. This means that permanent freedom from play can be achieved even if the contact surfaces of the locking mechanism wear over time. Accordingly, operational safety is further improved thereby.

Furthermore, in a particular development of the invention, two actuating elements such as two switches or buttons can advantageously be provided for actuating or operating the system. With an advantageous wiring of these, it can be ensured, for example, that the driving function and/or the changeover function is enabled (only) when the switches/buttons are, or are actuated in, the correct combination.

In general, the body of a construction vehicle, such as a dumper, concrete mixer, sprayer, etc., such as a bed, water/liquid tank, platform, crate or the like, can be optimized in each case for the transport of the particular goods, such as bulk

goods. In order to be able to use the construction machine or the base vehicle in a more versatile manner, a semi-automatic body change system can be used.

A construction machine system according to the invention, i.e. for example one or more common base vehicles with one or more possibly different tipping or bed bodies and/or with a liquid tank and/or a platform etc., can achieve the following requirements or the following advantages individually or in combination:

- The construction machine or the base vehicle, such as a dumper, should be able to continue to perform its main task, i.e. the transport of goods such as bulk materials, unrestricted.
- The body should be able to be interchanged by a single person without the use of additional machinery such as a crane, and without the use of tools.
- The body should be locked automatically and without play in order to reduce, for example, additional dynamic forces introduced into the system to a minimum.
- If the locking components become worn, the play-free connection can remain.
- The body is to be lifted automatically.
- The body can be interchanged within 20 minutes.
- Semi-automatic and play-free body changing system that is operated by only one hydraulic cylinder.
- Lifting the body at an angle.

Exemplary embodiment

An exemplary embodiment of the invention is illustrated in the drawing and is explained in more detail below with reference to the figures.

In detail:

Fig.1 is a perspective view of a construction vehicle according to the invention,

Fig. 2 is an enlarged detail from Fig. 1,

Fig. 3 is a side view of the drive of the coupling elements,

Fig. 4 is a side view of the drive of the coupling elements and the lifting device in different positions,

Fig. 5 is a perspective view of the arrangement of a locking button,

Fig. 6 to 8 are partial views of the construction vehicle in longitudinal section in different phases when putting down an interchangeable body,

Fig. 9 and 10 are perspective views of the construction vehicle in different phases when putting down an interchangeable body,

Fig. 11 to 13 are details of the side views of the unlocking and lifting phase or of a decoupling phase in different positions, and

Fig. 14 and 15 are side views of the drive cylinder with a knee lever and slot in different positions.

Fig. 1 shows a base vehicle 1 for an interchangeable body according to the invention with driver's cab 2, vehicle frame or chassis 3 and road wheels 4. In the shown embodiment, the base vehicle 1 has an articulated steering 5, i.e. the chassis 3 consists of two chassis parts 6, 7 which are connected via an articulated joint 8. Of course, the base vehicle 1 can however also have all other generally known types of steering such as kingpin steering, skid steering, rear-wheel, front-wheel, or all-wheel steering which, in addition to road wheels 4, also includes chain drives and/or pendulum axles or the like. For reasons of clarity and streamlining, a more detailed description and further explanations of other types of steering and chain drives have been omitted.

As can be seen in the enlargement of Fig. 2, there is a clamping cylinder 9 in the middle in the rear chassis part 6, which carries a clamping wedge 10 at the front and is fastened to the chassis at the rear via a bolt 11. A control button 12 is attached to the front chassis part 7 to operate the clamping cylinder outside the driver's cab 2.

In Fig. 3, the clamping wedge 10 attached to the piston rod with its clamping surface 13, which extends downwards from the front rearwards, can be better seen. On its upper side 14, the clamping wedge 10 is flat and slides along clamping plates 15. With the clamping surface 13, the clamping wedge 10 clamps a front locking bolt 16 downwards, which bolt belongs to an interchangeable body, and locks said bolt to the chassis 3 of the base vehicle 1.

In Fig. 3, behind the clamping cylinder 9, a receiving claw 17 with two guide surfaces 18, 19 extending towards each other from the back to the front is also shown. Without further illustration, however, two receiving claws 17 and two locking bolts 21 are advantageously available, which can be arranged on both sides or at the left and right on a frame 22 and/or the chassis 3.

These two receiving claws 17 are preferably firmly attached to the chassis 3 and have a receiving opening 20 at the rear, through which a rear locking bolt 21 of the interchangeable body can be received in the particular receiving claw 17 and locked or clamped there. Of the interchangeable body itself, only a frame 22 with front and rear tabs 23, 24 for fastening the front and rear locking bolts 16, 21 is shown in this illustration.

In Fig. 4, three representations a, b, c with different positions 10, 10', 10" of the clamping wedge 10 can be seen. In the position of the upper illustration a, the clamping wedge 10 clamps the front locking bolt 16 of an interchangeable body. In the position of the middle illustration b, the tension is released so that the locking bolt 16 is free.

In the position of the lower illustration c, the clamping cylinder 9 is completely retracted and a knee lever 25, consisting of two individual levers 26 which are connected by a joint 28, is lifted, wherein the knee lever 25, or the front individual lever 26, also has a front side 27. The front single lever 26 is entrained when the clamping cylinder 9 is retracted, via a slotted guide (not shown in detail), which provides the knee lever 25 with freewheeling during the transition between the positions shown in illustrations a and b. In illustration c, the front locking bolt 16 is no longer shown, which corresponds to a removed interchangeable body. In the particular variant of the invention shown in Fig. 4c), the front side 27 of the front

individual lever 26 can advantageously form a support or a contact surface for an interchangeable body and thus a point of engagement of the lifting unit formed by the knee lever 25 on the interchangeable body.

As an alternative to the shown above-mentioned particular variant of the invention, the joint 28 can, for example, have two rollers arranged on both sides (not further illustrated), which form the support or contact surfaces for the interchangeable body and thus the point of engagement of the lifting unit formed by the knee lever 25 on the interchangeable body so that the interchangeable body can advantageously roll and/or rest on/at these advantageous rollers.

Fig. 5 shows an advantageous centering bolt 21 which is mounted on the interchangeable body. The centering bolt 41 extends along the longitudinal axis of the interchangeable body and is received on both sides by two stops 42 which are fastened to the vehicle, wherein only one of the stops 17 is shown in Fig. 5. This advantageously, among other things, prevents the interchangeable body from slipping sideways, for example in the case of a large transverse incline. The stops 42 on both sides of the vehicle frame prevent lateral slipping. At the same time, the centering bolt serves as a trigger for a sensor 29 to detect the locked position. A locking button 29 acts as the sensor 29 for detecting the locked position of an interchangeable body and thus for detecting whether the base vehicle is with or without a body.

In Fig. 6 to 8, an interchangeable body in the form of a bed body 30 is shown partially, and in Fig. 9 and 9, it is shown in full in a perspective view. A tipping cylinder 31 is part of the interchangeable body 30 and enables the tipping of a bed 32 of the bed body 30.

Fig. 6 to 10 serve to illustrate the installation and removal of the bed body 30 on the base vehicle 1. The lifting of the body and its locking are realized with the hydraulically operated clamping cylinder 9. To do this, the driver in the cab can switch between a driving mode and a changeover mode using a switch. In driving mode, the clamping cylinder is held within a specified pressure range by hydraulic re-tensioning. The control button 12 is deactivated in drive mode. In change mode,

the base vehicle 1 can no longer be maneuvered. The automatic re-tensioning is deactivated, and the button 12 is activated.

In driving mode, the clamping cylinder 9 is pressurized. As a result, the clamping wedge 10 is clamped between the clamping plates 15 and the front locking bolt 16. The wedge shape creates a force on the interchangeable body 30 in the negative z-direction, i.e. downwards, whereby the interchangeable body 30 is also pushed forward in the X-direction. The interchangeable body is therefore clamped without play between two receiving claws 17 on both sides and the clamping wedge 10. If the locking bolts 16, 21, the receiving claws 17 or the clamping wedge 10 become worn out over time, the entire system remains free of play because the clamping cylinder is under pressure and is automatically re-tensioned.

When switching to the change mode, the situation remains unchanged, but the clamping cylinder 9 is no longer re-tensioned. In this situation, in order to change the interchangeable body 30, the rear supports 33 are attached to the interchangeable body 30, for example inserted into a holder (not shown in detail) or folded out from the interchangeable body if they are arranged directly on the interchangeable body.

As shown in Fig. 7, in the changeover mode, the operating button 12 is then actuated which causes the clamping cylinder 9 to be retracted. In the process, the clamping wedge 10 first releases the front locking bolt 16. As soon as the freewheeling of the knee lever 25 has been completed, it is entrained by the clamping cylinder 9 and the interchangeable body 30 is thereby lifted, which is shown in particular in Fig. 8. Front supports 34 are then attached to the interchangeable body 30, for example inserted into a holder (not shown in detail). This situation is shown in Fig. 9.

In principle, it is advantageous to carry along the supports 33, 34 on the base vehicle 1 and/or on the interchangeable body 30, e.g. with a fixing mechanism such as a lock etc. and/or in a storage space or drawer or the like (not shown in detail). As an alternative to manually attaching and/or inserting the supports 33, 34, this can also be achieved semi-automatically/automatically with a support drive, in particular with hydraulic and/or electrical actuators such as hydraulic

cylinders or electric motors, etc. The same can also be achieved with an optionally provided length adjustment with the option of fixing, either manually and/or semi-automatically/automatically.

If the knee lever 25 is now lowered by extending the clamping cylinder, the interchangeable body rests on its rear 33 and front 34 supports, and the base vehicle 1 can be driven out from under the interchangeable body 30 after activating the driving mode, as can be seen in Fig. 10.

The receiving of an interchangeable body 30 takes place in the reverse order. The interchangeable body 30 is put down on its supports 33, 34. The clamping cylinder 9 is extended so far that the knee lever 25 is in the lowest position. Now the base vehicle 1 can be driven under the interchangeable body 30.

In an advantageous embodiment, the interchangeable body can have side guide plates as well as front and rear stops (not shown in more detail). These side guide plates advantageously bring the interchangeable body into the correct lateral position in relation to the base vehicle 1. The front and rear stops limit the entry depth of the base vehicle 1 and thus ensure the correct final position in the direction of backward travel. Once the final position for receiving the interchangeable body 30 has been reached, it can be received.

For this purpose, the operator switches to the change mode and then retracts the clamping cylinder using the operating button 12, whereby the interchangeable body 30 is lifted. Now the front supports 34 are removed and the interchangeable body is lowered by extending the clamping cylinder 9 and simultaneously lowering the knee lever 25. When the clamping cylinder 9 is extended further, the interchangeable body 30 is locked to the base vehicle 1 by the clamping wedge 10 and the locking bolts 16, 21. Through the tipping movement of the interchangeable body 30 occurring when the knee lever 25 is lowered, the rear supports 33 are relieved of load, and they can thus also be removed.

The operator then still has to establish the hydraulic connections, which are preferably designed as quick-release couplings, and the electrical connections, which are preferably designed as plug connections. The switch back to driving

mode can now be carried out, and the base vehicle 1 is ready for use with the received interchangeable body 30.

In addition, further details of the interchange process, in particular the uncoupling, or its individual method steps are shown schematically in Fig. 11 to 15 and are briefly described below. The following explanations and descriptions refer to the illustrated embodiment, i.e. base vehicle 1 with articulated steering 5 and bed body 30 as an interchangeable body 30. However, these explanations and descriptions are, and are intended, to be of a general nature and can also be applied to (all) other base vehicles 1 and interchangeable bodies 30, i.e. front-wheel, rear-wheel, all-wheel or skid steering, and/or bed, tank, concrete mixer bodies, or the like:

Fig. 11a) or Fig. 14a) or Fig. 4a) or Fig. 6: putting down the interchangeable body 30 (not shown in more detail) or the platform/supporting frame 49 of the interchangeable body 30: the process begins/takes place substantially in a (lower) locked/tensioned/fixed basic position of the interchangeable body 30, wherein two of the coupling elements 21, 10, 16, 17, i.e. according to Fig. 11a), the rear locking bolt 21 and the clamping wedge 10, have a distance A1; optional or advantageous attachment of the rear supports 33 to the interchangeable body 30 or its support frame 49; unlocking, wherein the clamping wedge 10 moves with the aid of the drive 9 or hydraulic cylinder 9 along a freewheel 44 or slot 44 to the left along the arrow P, wherein in particular Fig. 14a) shows that a driver element 45 or bolt 45 is freely movable in the freewheel 44 or slot 44 so that a carriage 46 or its base element 47 remains unadjusted or immobile.

Fig. 11b) to 12b) or Fig. 14a) to 14d): the clamping wedge 10 moves, with the help of the drive 9 or hydraulic cylinder 9, further along the freewheel 44 or slot 44 to the left along the arrow P until, as Fig. 12b) or 14d) illustrate, the driver element 45 or the bolt 45 strikes the end of the freewheel 44 or slot 44 and from then can no longer be moved therein, wherein the carriage 46 or its base element 47 remain unadjusted or immobile, wherein the corresponding two coupling elements 21, 10, 16 or the rear locking bolt 21 and the clamping wedge 10 or alternatively (not shown) have a distance A2 to the front bolt 16, wherein the distance A2 is smaller than the distance A1 by a the (previous) stroke of the drive 9 or hydraulic cylinder 9, the interchangeable body 30 or its support frame 49 is now unlocked.

Fig. 12c) or Fig. 15a): the clamping wedge 10 or a piston rod of the drive 9 or cylinder 9 moves further along the arrow P; the driver element 45 or the bolt 45 striking the freewheel 44 entrains a base element 47 of a carriage 46, wherein the carriage 46 is connected to the knee lever 25 by a joint 48 so that the knee lever 25 can be rotated relative to the carriage 46; the knee lever 25 or its components partially lift off in the vertical direction H, in particular a front side 27 which is designed as a contact surface 27 and/or engagement element 27; the interchangeable body 30 or its support frame 49 rotate about an axis of rotation D1 with a first radius R1; the rear support or supports 33 are also rotated about the axis of rotation D1 and are lowered downwards towards the floor 43, wherein optionally, the support 33 can also have a length adjustment with fixing option (not shown), e.g. clamped and/or locked, in order to be advantageously (roughly) adaptable to the height or the distance from the floor 43, i.e. the wedge 10 had arrived at the end of the slot 44 and from this point/state then entrains the carriage 46 with the knee lever 25 to the left or along arrow P, wherein the knee 25 now moves upwards until it strikes a contact surface of the interchangeable body 30 or its support frame 49 so that it rotates or is tilted about the axis of rotation D1.

Fig. 12d) or Fig. 15a): the clamping wedge 10 or the piston rod of the drive 9 or cylinder 9 moves further along the arrow P; the driver element 45 or the bolt 45 striking the freewheel 44 continues to entrain the base element 47 of the slide 46; the floor supports 33 touch the floor 43 or are supported on the floor 43 so that the interchangeable body 30 or its support frame 49 from then on rotate about a second axis of rotation D2 with a second radius R2, i.e. by means of a skid 42 or floor contact surface; the bolt 21 is levered out of the holder 21 or lifts off in the vertical direction H, wherein optionally or as an advantageous alternative, the skid 42 can also be designed without a free-swinging separate foot (see illustration) and wherein advantageously instead, for example, a firmly attached, in particular curved base plate of the skid 42 is arranged on the support 33, wherein this also results in a rolling movement or a rotation about an axis of rotation D2 correspondingly arranged on the floor 43, i.e. on the (curved) floor plate or its contact surface (not shown).

Fig. 13a) to 13b) or Fig. 15b) to 15d) or Fig. 4c): the clamping wedge 10 or the piston rod of the drive 9 or cylinder 9 moves further along the arrow P; the driver element 45

or the bolt 45 striking the freewheel 44 continues to entrain the base element 47 of the carriage 46, i.e. the lifting mechanism lifts the body to the end position.

Fig. 13c) to 13d) or Fig. 15c) to 15d) or Fig. 9: the front supports 34 are inserted laterally or brought into the support position; then the side supports 34 are brought/adjusted to the correct length and fixed, e.g. clamped and/or locked; then the clamping cylinder 9 can move forward again, i.e. opposite the arrow P, wherein the body 30 is lowered (not shown in more detail) until the side supports 34 have full contact with the floor; from this point onwards, the body 30 can be described as put down, and the base vehicle 1 can move away or drive away.

The interchangeable body 30 is received in the correspondingly reverse order. Further details such as electrical contact protection or presence monitoring of the interchangeable body 30 and/or of the locking, etc., by means of sensors, switches 12, or actuators or the like are not explained in detail here, but can be advantageously added or provided.

Another great advantage of the interchange system according to the invention is also that there are no active or energy-consuming components on the interchangeable body 30 so that the energy for the interchanging, i.e. uncoupling and coupling, or the drive can be realized not only together with a single drive, but also exclusively at the base vehicle. Accordingly, for example, the hydraulic system and/or electric drive system of the base vehicle 1 can be used.

List of reference signs

1	Base vehicle
2	Driver's cab
3	Chassis
4	Road wheel
5	Articulation/steering
6	Chassis part
7	Chassis part
8	Articulated joint
9	Clamping cylinder
10	Clamping wedge
11	Bolt
12	Operating button
13	Clamping surface
14	Top side
15	Clamping plate
16	Front locking bolt
17	Receiving claw
18	Guide surface
19	Guide surface
20	Receiving opening

21	Rear locking bolts
22	Frame
23	Tab
24	Tab
25	Knee lever
26	Single lever
27	Front side
28	Joint
29	Locking button
30.	Interchangeable body
31	Tilt cylinder
32	Bed
33	Rear support
34	Front support
41	Centering bolt
42	Skid
43	Floor
44	Slot/freewheel
45	Bolt
46	Carriage
47	Base element

48	Joint
49	Support frame
A	Distance
D	Axis of rotation
H	Lifting/lift direction
P	Arrow/adjustment direction
R	Radius

PATENTKRAV

1. Entreprenørmaskine med et basiskøretøj (1) og et karosseri, især et dumperkarosseri med en tippeenhed, hvor basiskøretøjet omfatter en førerenhed, især med en førerkabine (2), og en styringsenhed til styring af basiskøretøjet, især en knækstyring (5) med et drejeled (8), en skridstyring, en svingakselstyring, en baghjuls-, forhjuls- eller firehjulsstyring, hvor især drejeleddet (8) er anbragt mellem to i forhold til hinanden drejelige køretøjsenheder (6, 7) af basiskøretøjet (1), hvor basiskøretøjet (1) omfatter en i køretøjssiden placeret koblingsenhed (9, 10, 11) til til- og/eller frakobling af et veksellad (30) med et eller flere i køretøjssiden placerede koblingselementer (10, 17), og hvor der er tilvejebragt et veksellad (30), der omfatter et eller flere i karosserisiden placerede koblingselementer (16, 21) til tilkobling af vekselladet (30) til basiskøretøjet (1), hvor der er tilvejebragt i det mindste en første drejetap (D1), om hvilken vekselladet (30) kan drejes med en første radius (R1) under til- og/eller frakoblingen, hvor der er tilvejebragt en løfteindretning (25) med en løftedrivmekanisme (9) til løft af vekselladet (30), hvor basiskøretøjet (1) omfatter en som oplåse-/låse- og/eller spændeenhed (9) udformet drivenhed og i det mindste et første i køretøjssiden placeret koblingselement (10) af koblingsenheden (9, 10, 11), hvilket koblingselements position kan ændres af drivenheden (9), hvor den som oplåse-/låse- og/eller spændeenhed udformede, især lineære, drivenhed (9) også er udformet som løfteindretningens løftedrivmekanisme, **kendetegnet ved, at** et bageste i køretøjssiden placeret koblingselement (17) omfatter en fra bag til for nedad forløbende styreflade (18), og et forreste i køretøjssiden placeret koblingselement (10) omfatter en fra for til bag nedad forløbende oplåse-/låse- og/eller spændeflade (13), og/eller ved, at, i en tilstand for vekselladet (30), i hvilken det er låst og/eller fastspændt til basiskøretøjet (1), et bageste i karosserisiden placeret koblingselement (21) går i indgreb nedefra med den nedad forløbende styreflade (18) af det bageste i køretøjssiden placeret koblingselement (17), og et forreste i karosserisiden placeret koblingselement (16) går i indgreb nedefra med den nedad forløbende oplåse-/låse- og/eller spændeflade (13) af det forreste i køretøjssiden placeret koblingselement (19).

2. Entreprenørmaskine ifølge krav 1, **kendetegnet ved, at** drivenheden er en lineær drivenhed, især en hydraulisk løftecylinder (9), hvor i det mindste to i

køretøjssiden eller karosserisiden placerede koblingselementers (10, 16, 21) afstand (A) fra hinanden kan ændres af drivenheden (9).

3. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** en justerings- og/eller drivretning for den lineære drivenhed (9) og/eller for det første i køretøjssiden placerede koblingselement (10) er parallel med basiskøretøjets (1) længderetning og/eller kørselsretning, især ved ligeudkørsel.

4. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** løfteindretningen (25) omfatter i det mindste et indgrebselement (27), med en kontaktflade, til anbringelse på vekselladet (30) og/eller til løft af vekselladet (30) i en løfteposition, hvor især tyngdepunktet for vekselladet (30), i det mindste i løftepositionen, befinder sig mellem indgrebselementets (27) kontaktflade og det første drejeled (21, D1), og/eller ved, at løfteindretningen (25) i løftepositionen med henblik på løft af vekselladet (30) går i indgreb med vekselladet (30) med et indgrebselement (27), der er anbragt foran vekselladets (30) tyngdepunkt set i forhold til den første kørselsretning, især den fremadrettede kørselsretning med en foran karosseriet anbragt førerenhed og/eller førerkabine (2).

5. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** løfteindretningen omfatter en vægtarmanordning (26), især en vinkelarm (25), hvor især vægtarmanordningen (26) og/eller vinkelarmen (25) omfatter kontaktfladen og/eller indgrebselementet (27).

6. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** i det mindste en første drivfase for den især som løftedrev udformede drivenhed (9) er udformet som oplåse-/låse- og/eller spændefase, og ved, at en anden drivfase for den især som løftedrivmekanisme udformede drivenhed (9) er udformet som løfte- eller sænkefase for løfteindretningen.

7. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** der er tilvejebragt et friløb over en fritløbsbane, især i form af en langhulsføring med et til vægtarmanordningen (25, 26) forbundet anslagselement, hvor friløbsbanen er større end eller lig med en med henblik på

fastspænding og/eller låsning tilvejebragt afstandsændring mellem to med henblik på fastspænding og/eller låsning af vekselladet (30) tilvejebragte koblingselementer.

8. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** i det mindste et af de i køretøjssiden og/eller karosserisiden placerede koblingselementer (10, 16, 17, 21) omfatter en i forhold til basiskøretøjets (1) længdeakse og/eller kørselsretning skråt forløbende oplåse-/låse- og/eller spændeflade (13), hvor især i det mindste et af de i køretøjssiden og/eller karosserisiden placerede koblingselementer (10, 16, 17, 21) er udformet som oplåse-/låse- og/eller spændekile (10).

9. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** i det mindste et af de i køretøjssiden placerede koblingselementer (10, 17) omfatter en modtageåbning (20), der er rettet mod en fra førerenheden og/eller førerkabinen (2) bortvendende side, især mod en bagside, af basiskøretøjet (1), til modtagelse af i det mindste et af de i karosserisiden placerede koblingselementer (21).

10. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** det i køretøjssiden placerede koblingselement (17) med modtageåbning (20) omfatter to i forhold til en første kørselsretning, især en fremadrettet kørselsretning med en førerenhed og/eller førerkabine (2) anbragt foran karosseriet, mod hinanden skråt forløbende styreflader (18, 19).

11. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** der er tilvejebragt i det mindste en anden drejetap (D2), om hvilken vekselladet (30) kan dreje med en anden radius (R2) under til- og/eller frakoblingsfasen, hvor vekselladet (30) i en første drejefase kan dreje om den første drejetap (D1) og i en anden drejefase kan dreje om den anden drejetap (D2) .

12. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** den første drejetaps (D1) første radius (R1) er mindre end den anden drejetaps (D2) anden radius (R2).

13. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** den første drejetap (D1) er udformet som boltelement (21)

af vekselladet (30) og/eller som oplåse-/låse- og/eller spændeelement af oplåse-/låse- og/eller spændeenheden (9), og/eller ved, at den anden drejetap (D2) er udformet som støtteelement (42) af vekselladet (30).

14. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** der er tilvejebragt en sensorenhed (29), især i form af en mekanisk sensor, der kan bevæges ved hjælp af et i karosserisiden placeret koblingselement, med henblik på identifikation af et tilkoblet veksellad (30), og/eller ved, at basiskøretøjet (1) omfatter en kontrolenhed til en af arten af det tilkoblede veksellad afhængig kontrol af kørselshastigheden og/eller til en kontrol af kørselshastigheden, afhængigt af om et veksellad er tilkoblet eller ej.

15. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** der er tilvejebragt et betjeningselement (12), anbragt uden for førerenheden, til betjening af oplåse-/låse- og/eller spændeenheden (9).

16. Entreprenørmaskine ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** kontrolenheden omfatter i det mindste to driftstilstande, f.eks. en køretilstand og en skilletilstand, hvor der i køretilstanden er tilvejebragt en aktivering af i det mindste en kørefunktion, f.eks. automatisk efterspænding af oplåse-/låse- og/eller spændeenheden (9) og/eller kontrol af kørselshastigheden og/eller en deaktivering af en skillefunktion, f.eks. blokering af det uden for førerenheden anbragte betjeningselement, og/eller i skilletilstanden er tilvejebragt en deaktivering af en kørefunktion og/eller en aktivering af en skillefunktion, f.eks. udløsning af det uden for førerenheden anbragte betjeningselement.

17. Fremgangsmåde til drift af en entreprenørmaskine og/eller et basiskøretøj (1) med/til et karosseri, især et dumperkarosseri med en tippeenhed, hvor basiskøretøjet anvender en førerenhed, især med en førerkabine (2), og en styringsenhed til styring af basiskøretøjet, hvor basiskøretøjet (1) anvender en i køretøjssiden placeret koblingsenhed (9, 10, 11) til til- og/eller frakobling af et veksellad (30) med et eller flere i køretøjssiden placerede koblingselementer (10, 17), og hvor der anvendes et veksellad (30), der anvender et eller flere i karosserisiden placerede koblingselementer (16, 21) til tilkobling af vekselladet (30) til basiskøretøjet (1), hvor der anvendes i det

mindste en første drejetap, om hvilken vekselladet (30) drejes med en første radius under til- og/eller frakoblingen, hvor der anvendes en løfteindretning (25) med en løftedrivmekanisme (9) til at løfte vekselladet (30), hvor basiskøretøjet (1) anvender en som oplåse-/låse- og/eller spændeenhed (9) udformet drivenhed og i det mindste et første i køretøjssiden placeret koblingselement (10) af koblingsenheden (9, 10, 11), hvilket koblingselements position ændres af drivenheden (9), **kendetegnet ved, at** den som oplåse-/låse- og/eller spændeenhed udformede, især lineære, drivenhed (9) også udformes som løfteindretningens løftedrivmekanisme, hvor et bageste i køretøjssiden placeret koblingselement (17) omfatter en fra bag til for nedad forløbende styreflade (18), og et forreste i køretøjssiden placeret koblingselement (10) omfatter en fra for til bag nedad forløbende oplåse-/låse- og/eller spændeflade (13), og/eller ved, at, i en tilstand for vekselladet (30), i hvilken det er låst eller fastspændt til basiskøretøjet (1), et bageste i karosserisiden placeret koblingselement (21), går i indgreb nedefra med den nedad forløbende styreflade (18) af det bageste i køretøjssiden placeret koblingselement (17), og et forreste i karosserisiden placeret koblingselement (16) går i indgreb nedefra med den nedad forløbende oplåse-/låse- og/eller spændeflade (13) af det forreste i køretøjssiden placeret koblingselement (19).

18. Fremgangsmåde ifølge det foregående krav 17, **kendetegnet ved, at** i det mindste en første drivfase for den især som løftedrivmekanisme udformede drivenhed (9) udformes som oplåse-/låse- og/eller spændefase, og ved, at en anden drivfase for den især som løftedrivmekanisme udformede drivenhed (9) udformes som løfte- eller sænkefase for løfteindretningen.

19. Fremgangsmåde ifølge et hvilket som helst af de foregående krav 17 og 18, **kendetegnet ved, at** der anvendes i det mindste en anden drejetap (D2), om hvilken vekselladet (30) drejes med en anden radius (R2) under til- og/eller frakoblingsfasen, hvor vekselladet (30) drejer om den første drejetap (D1) i en første drejefase og drejer om den anden drejetap (D2) i en anden drejefase, hvor især den første drejetaps (D1) første radius (R1) udformes mindre end den anden drejetaps (D2) anden radius (R2), og/eller ved, at det første drejeled (D1) udformes som oplåse-/låse- og/eller spændeelement (21) af oplåse-/låse-

og/eller spændeenheden (9), og/eller ved, at det andet drejeled (D2) udformes som støtteelement (42) af vekselladet (30).

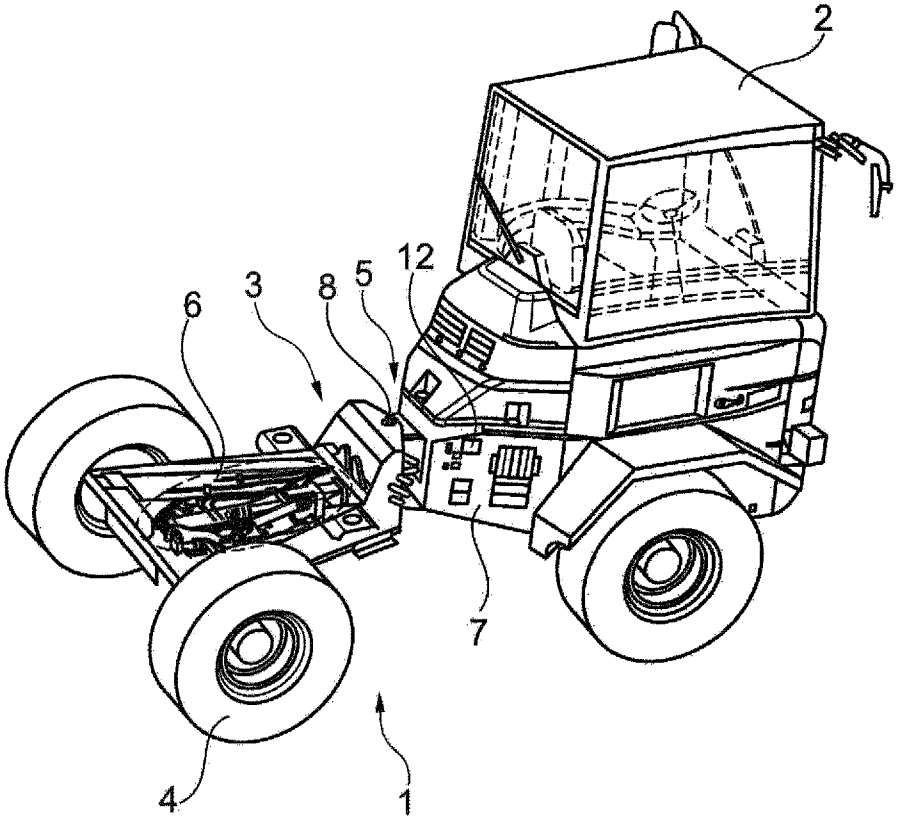


Fig. 1

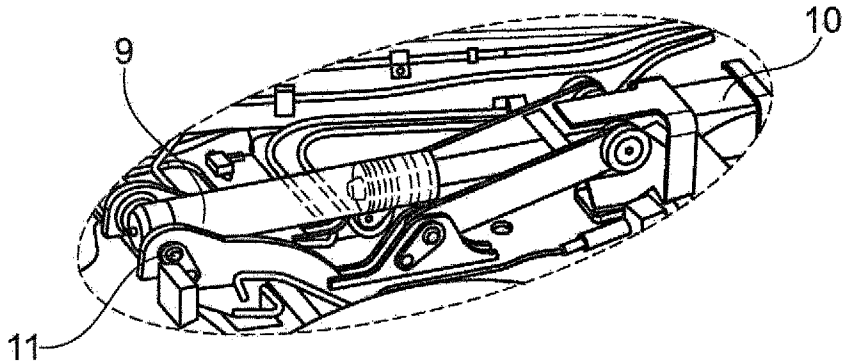


Fig. 2

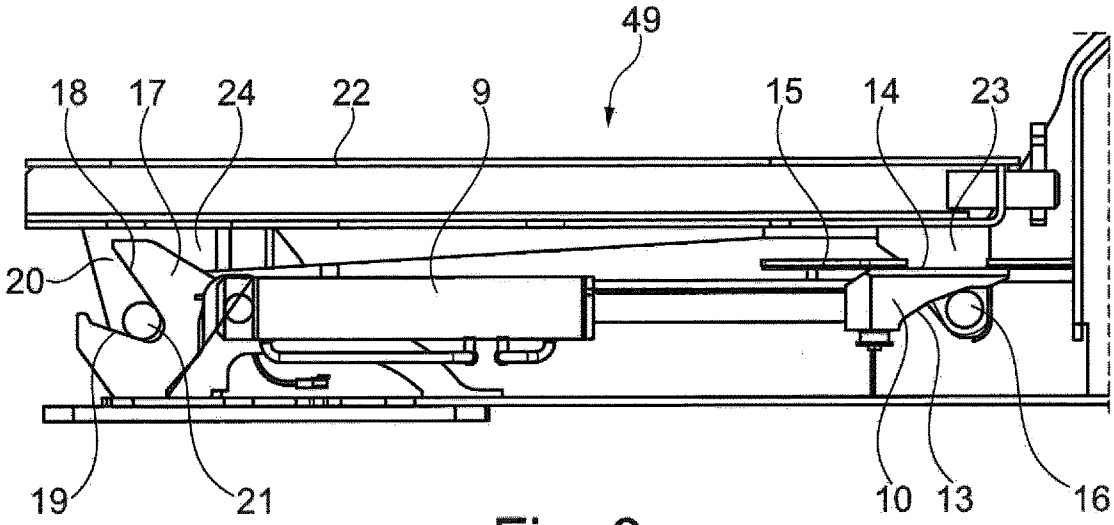

49
18
17
24
22
9
15
14
23
20
19
21
10
13
16

Fig. 3

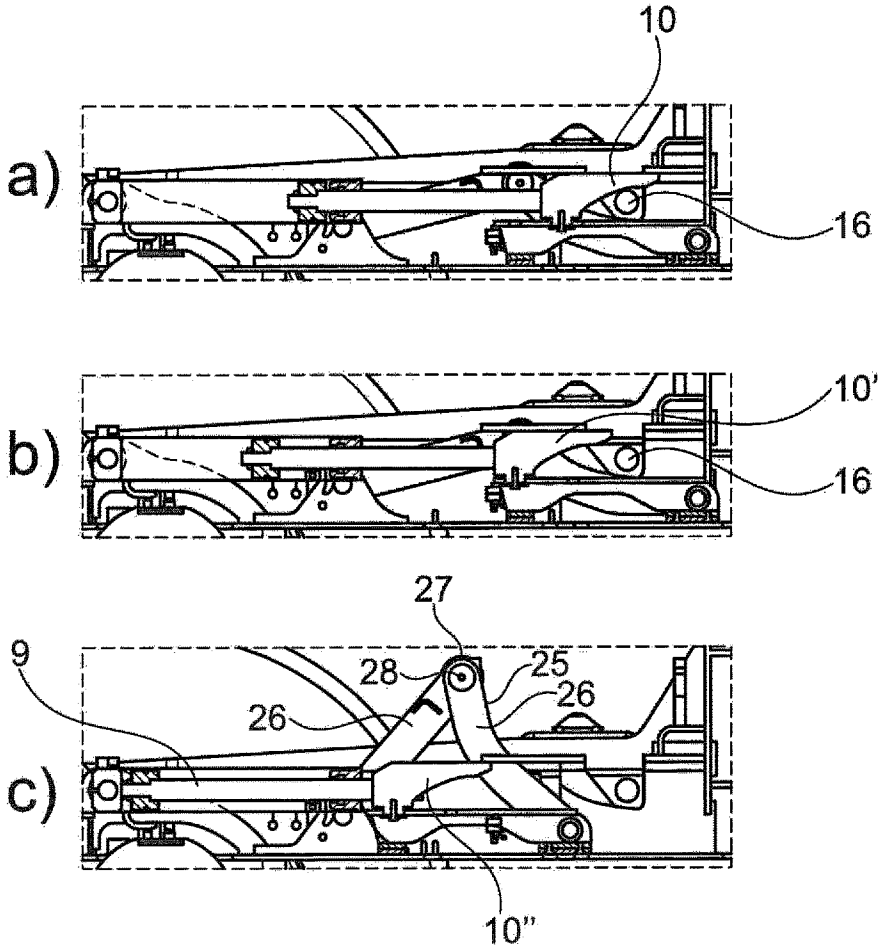

10
a)
16
10'
b)
16
27
9
28
25
26
26
c)
10''

Fig. 4

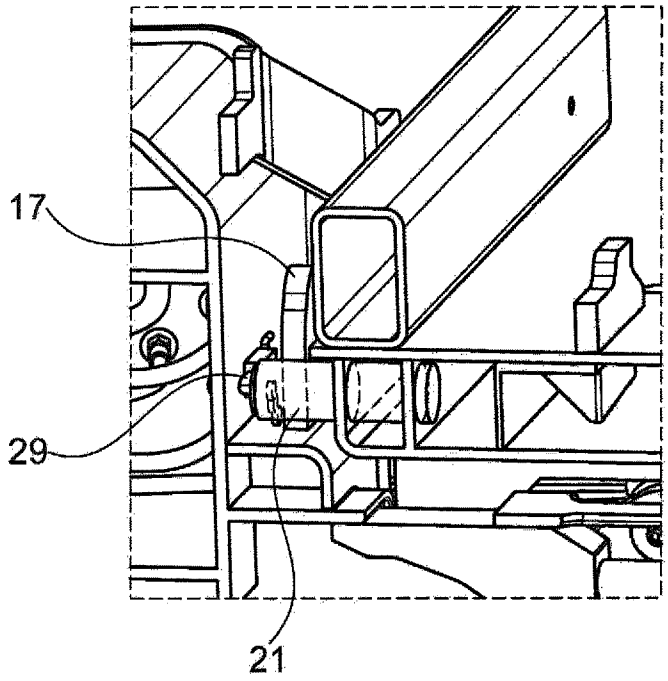


Fig. 5

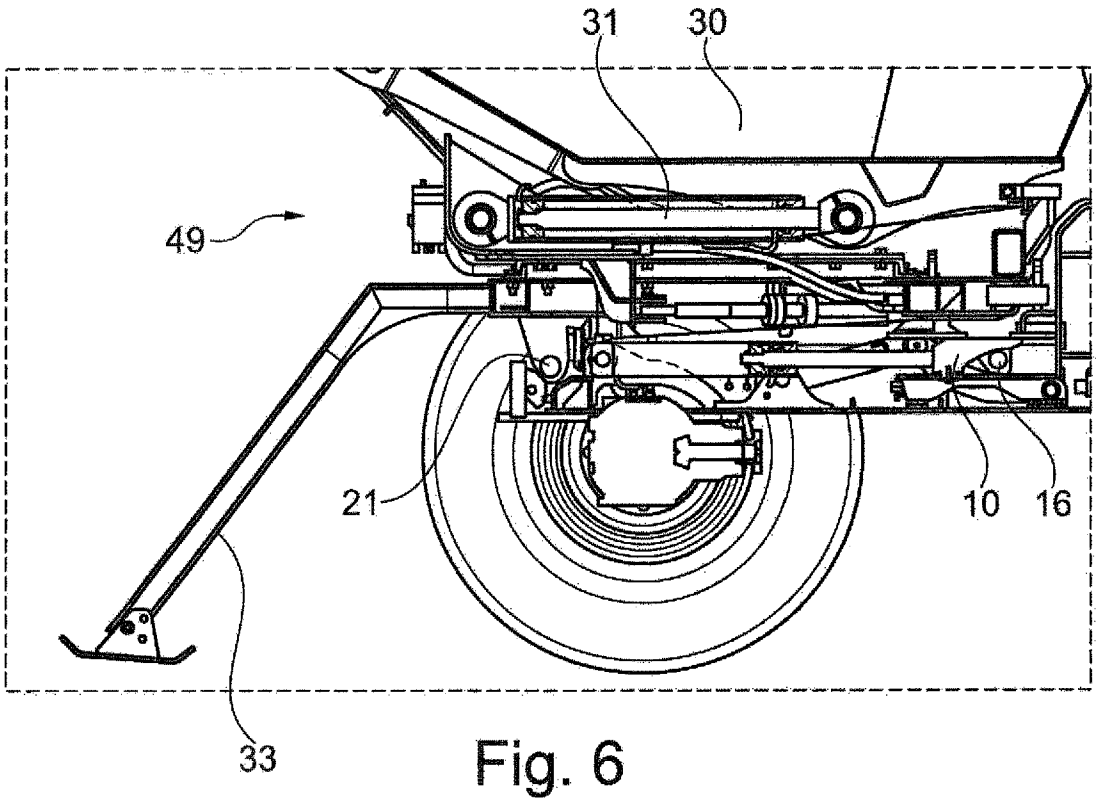


Fig. 6

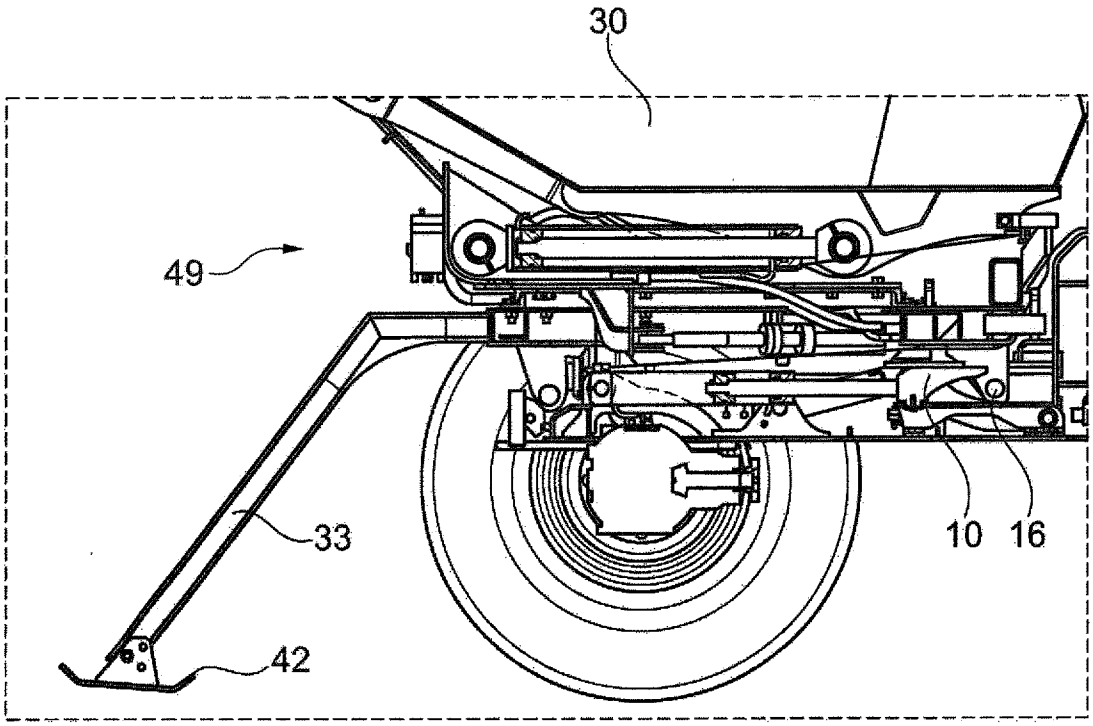


Fig. 7

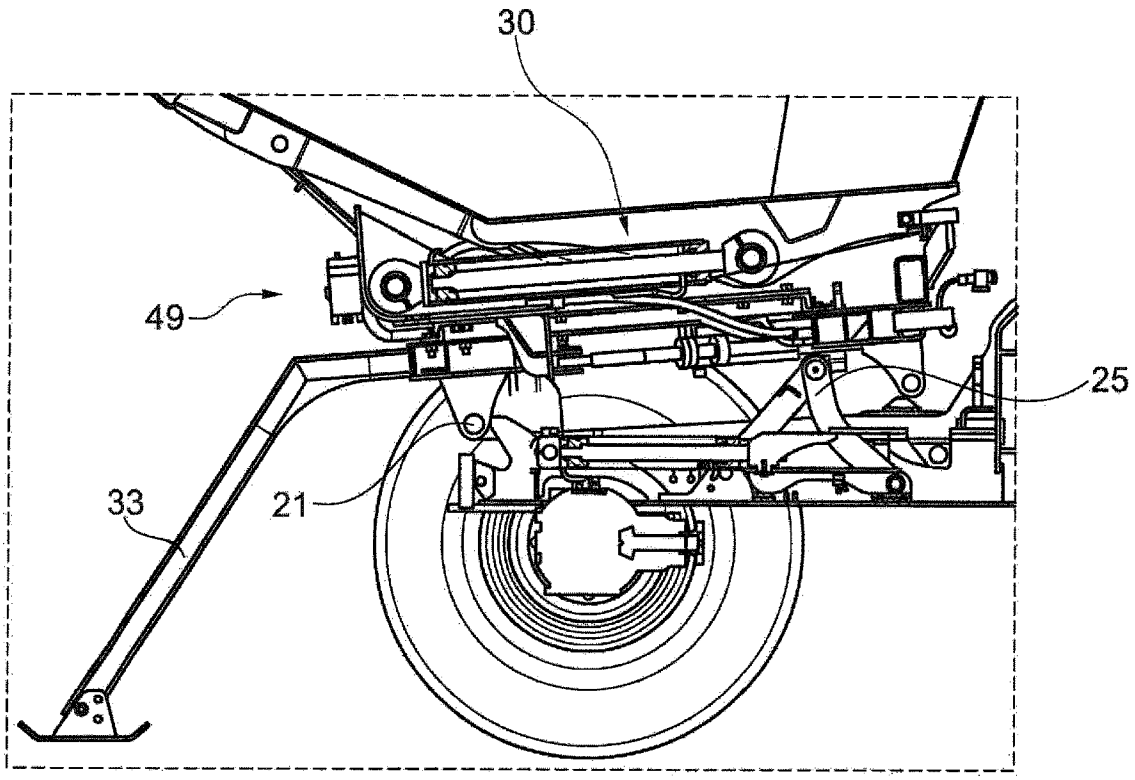


Fig. 8

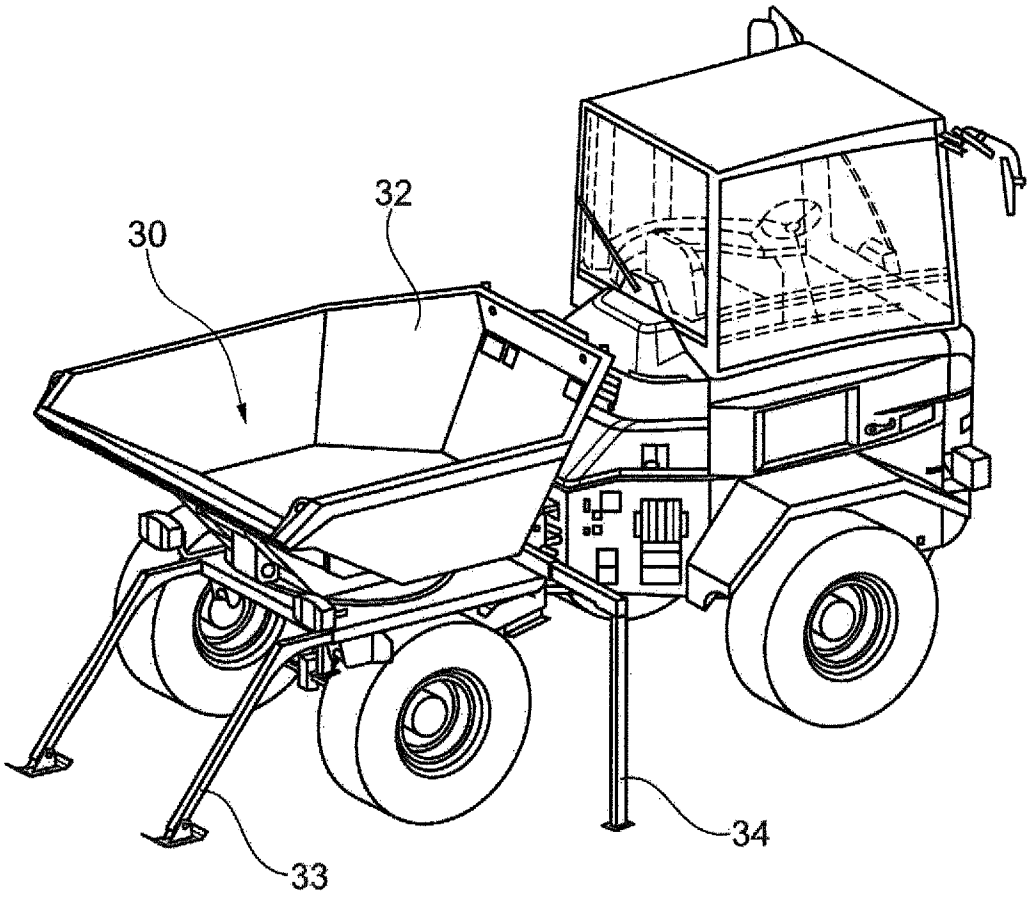


Fig. 9

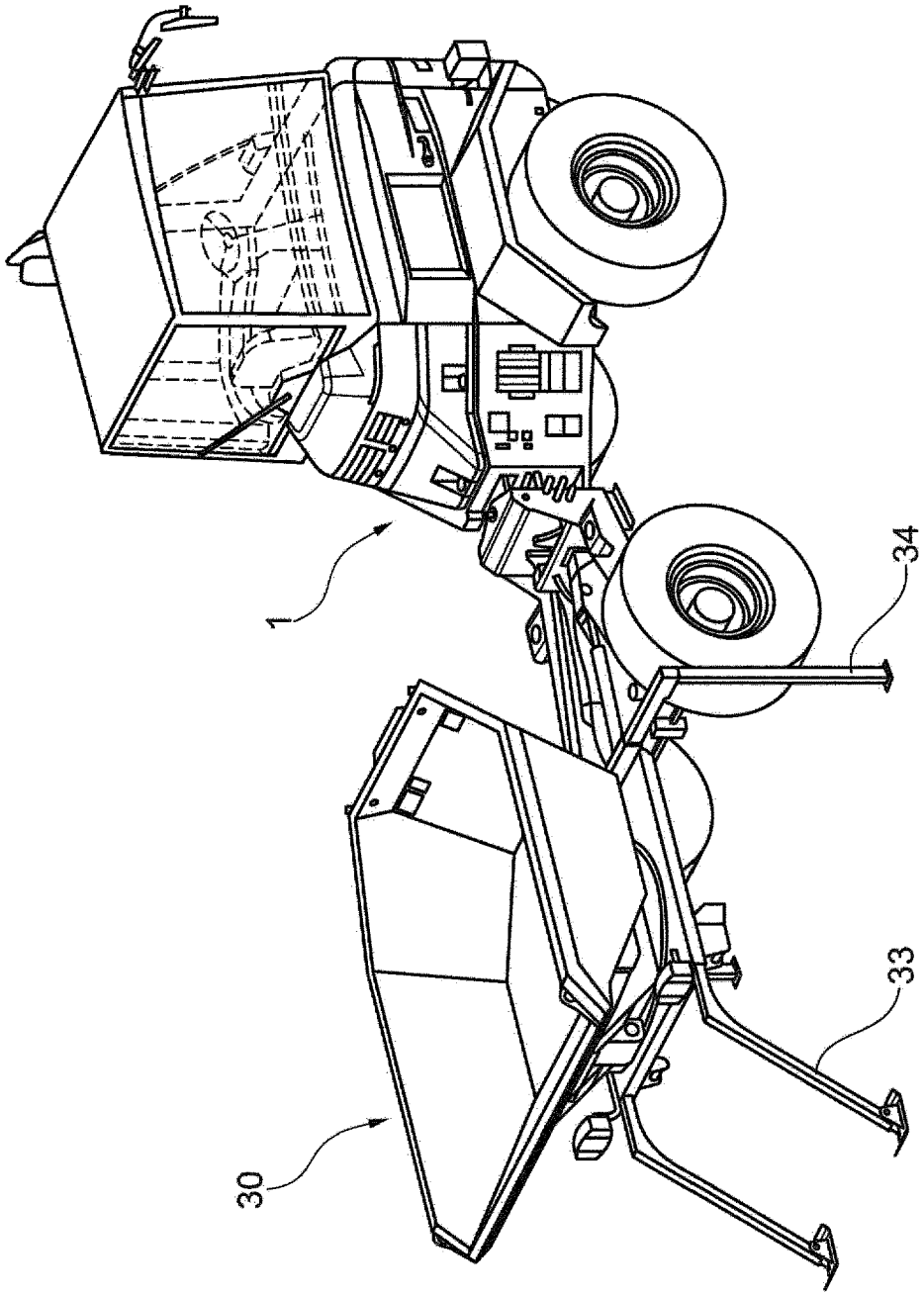
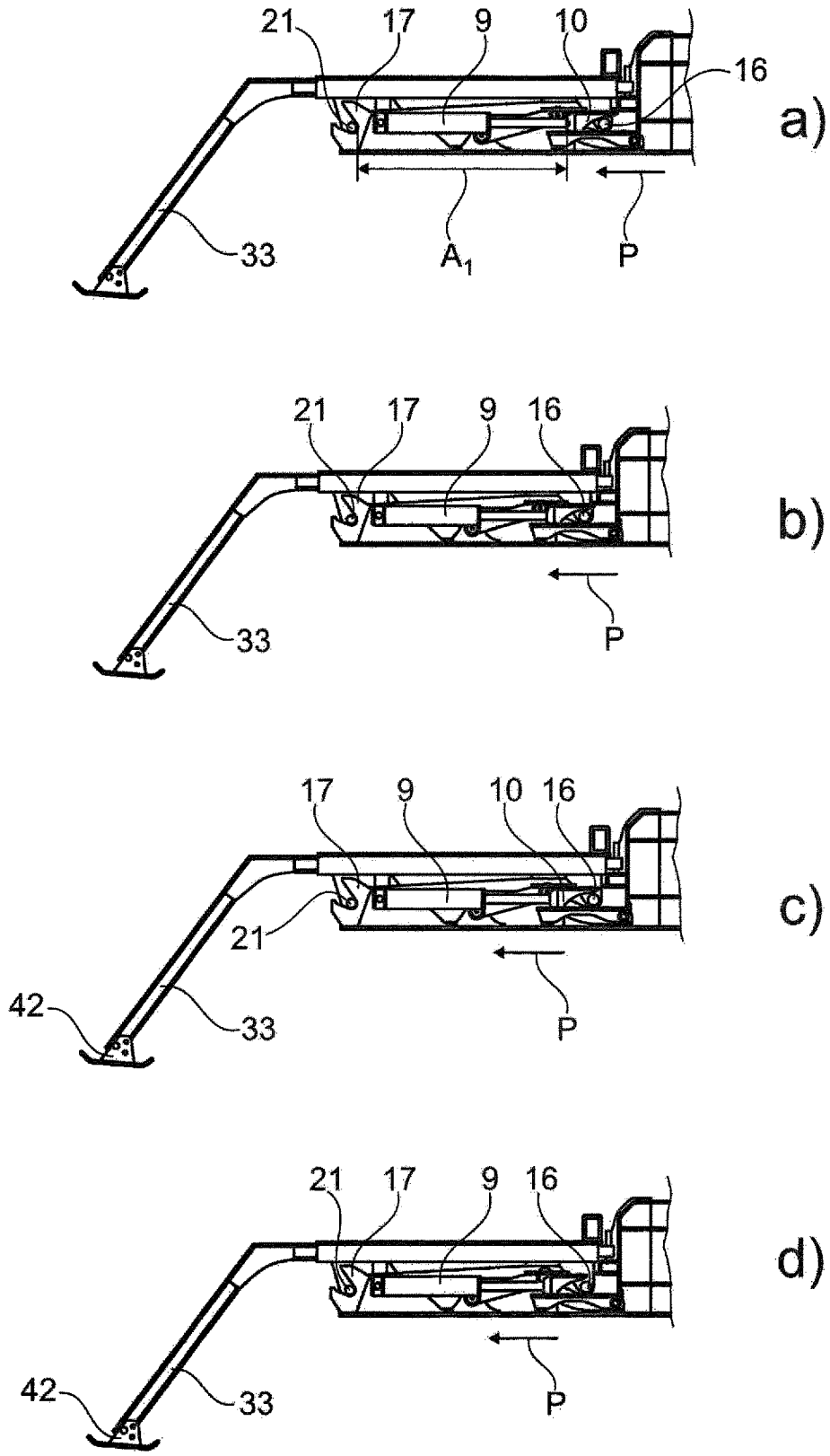


Fig. 10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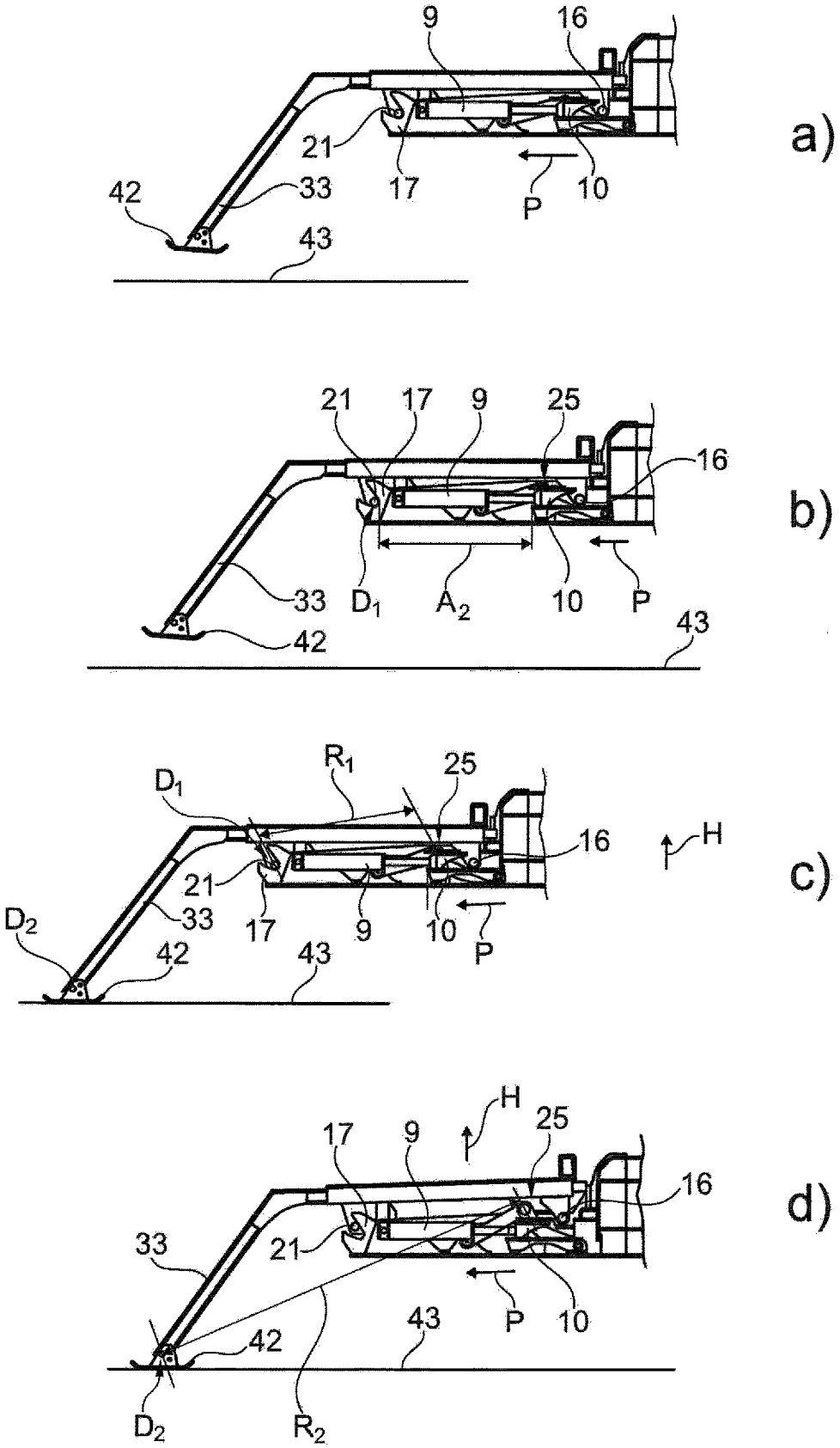
9
10
16
a)
33
A_1
P
21
17
9
16
b)
33
P
17
9
10
16
c)
21
42
33
P
21
17
9
16
d)
42
33
P

Fig. 11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33
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b)
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D_1
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10
P
42
43
c)
R_1
25
D_1
16
H
21
33
17
9
10
P
D_2
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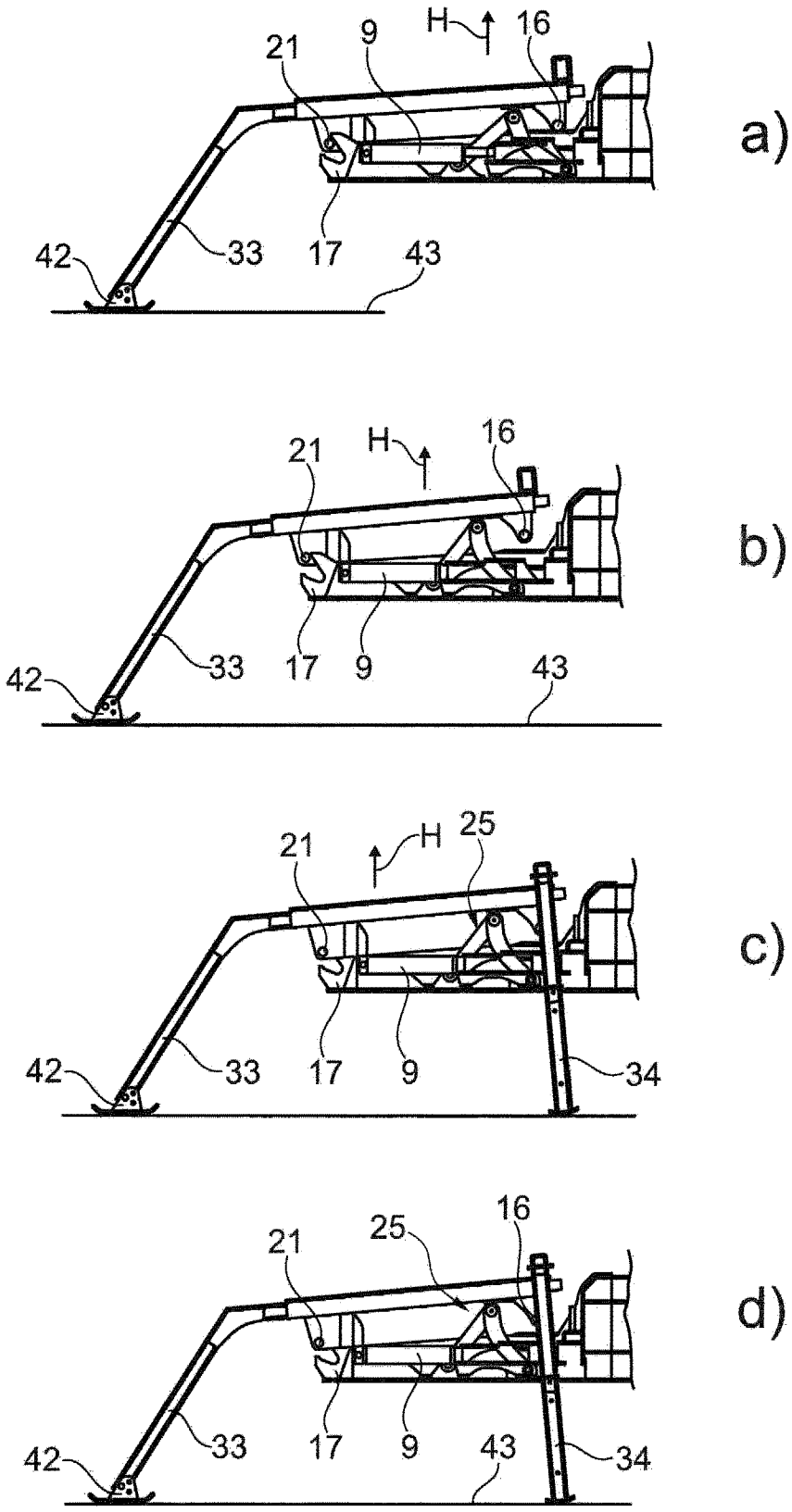
43
d)
H
17
9
25
16
33
21
P
10
43
42
D_2
R_2

Fig. 12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43
b)
21
H
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33
17
9
43
c)
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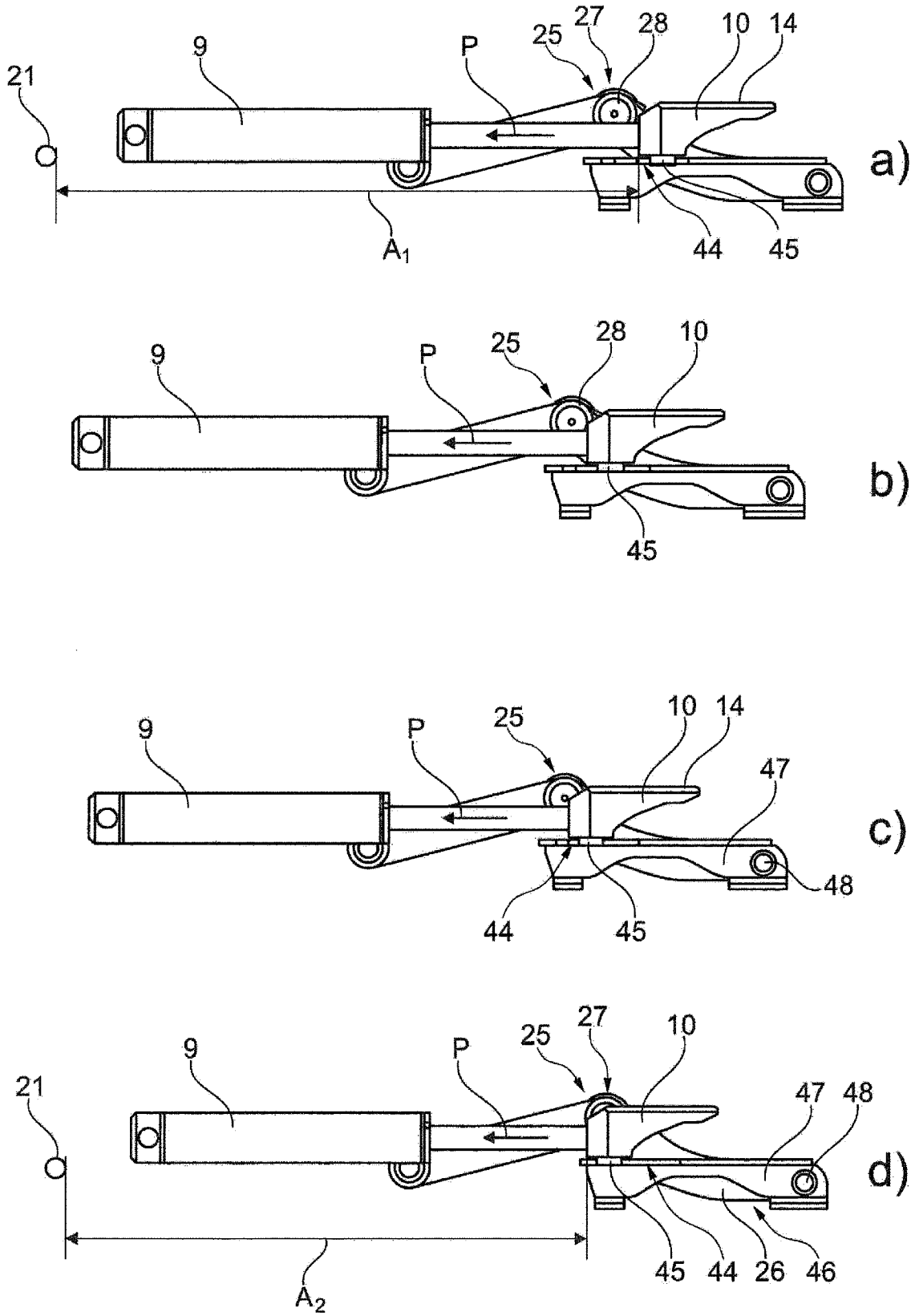
H
25
42
33
17
9
34
d)
16
25
21
42
33
17
9
43
34

Fig. 13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b)
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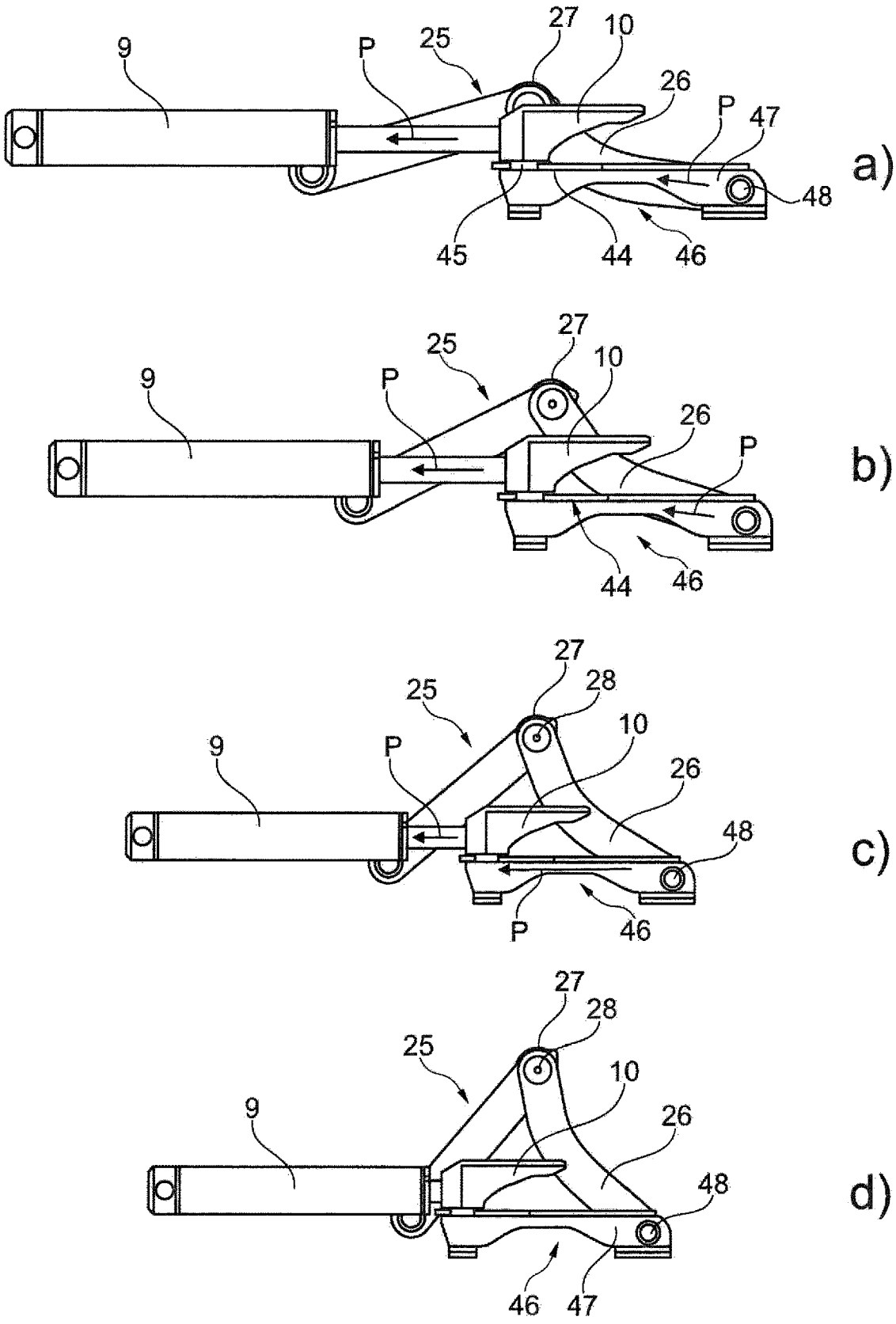
9
P
25
10
14
47
c)
48
44
45
21
9
P
25
27
10
47
48
d)
A2
45
44
26
46

Fig. 14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P
44
46
c)
9
P
25
27
28
10
26
48
P
46
d)
9
25
27
28
10
26
48
46
47

Fig. 15