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(54) IMPROVED TOWER WAGGON

(57) Tower wagon (1) which is equipped with a chassis (4) which is supported by front wheels (8), rear wheels (9) and intermediate wheels (10) and with a swing arm (14) having a front end (15), a rear end (16) and a pivot shaft (17) between both far ends (15,16), whereby the swing arm (14) is hinge-mounted on the chassis (4) about

the pivot shaft (17) which is oriented transversely to the longitudinal direction (LL') and whereby intermediate wheels (10) are mounted on the front end (15) of the swing arm (14) and rear wheels (9) are mounted on the rear end (16) of the swing arm (14).

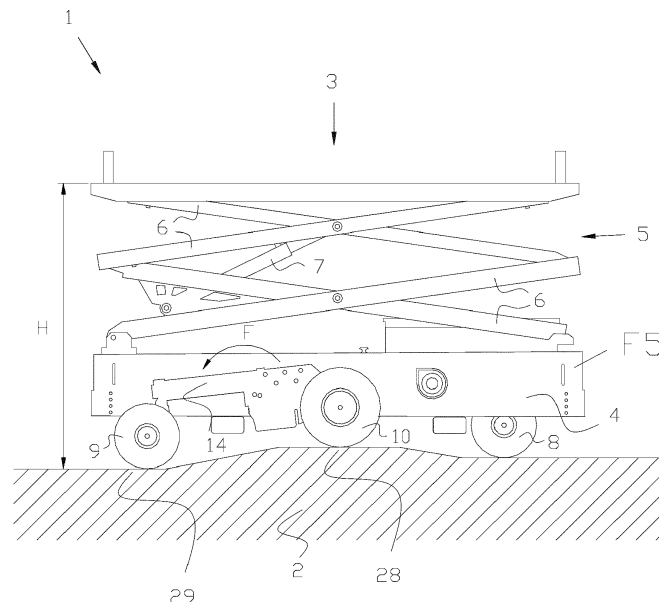


FIG 2

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Description

[0001] The present invention concerns an improved tower wagon.

[0002] In particular, the present invention concerns an improved tower wagon equipped with a work platform which can be moved up and down and which is provided on a mobile chassis.

[0003] Without limiting the invention thereto, an improved tower wagon according to the invention is particularly suitable for applications wherein the ground surface is not always flat and wherein, for example, pits or bumps are present in the ground surface.

[0004] In particular, an improved tower wagon according to the invention is ideally suited to be used in horticulture.

[0005] Nevertheless, an improved tower wagon according to the invention can also be used in other applications.

[0006] Tower wagons are already known in general, as well as tower wagons to be used in horticulture, but they have a number of disadvantages or are open to improvement.

[0007] More specifically, the usual tower wagons and in particular the electrically driven tower wagons are ill-suited for use on a ground surface which is not entirely level.

[0008] Indeed, when riding over a bump or a hole in the ground with a known tower wagon, a user on the working platform will be subjected to shocks and vibrations, which are even enforced as the working platform is generally set at high altitude.

[0009] This may lead to unsafe situations, whereby the user may lose his balance or whereby used equipment cannot be held firmly in hand and the like.

[0010] Another disadvantage of the known tower wagons consists in that, when there are pits or bumps in the ground surface, one or several wheels will often lose its grip on the ground surface, so that driving or moving such a tower wagon in such a condition will be more difficult or in some cases no longer possible at all.

[0011] Also, the present invention aims to remedy one or several of the above-mentioned and/or other problems.

[0012] More specifically, the aim of the invention is to provide an improved tower wagon which is capable of maintaining the working platform stable while driving over bumps or pits in the ground surface.

[0013] Another aim of the invention is to increase the safety with regard to working on a tower wagon.

[0014] Yet another aim of the invention is to provide an improved tower wagon which can be moved more easily, also when there are pits or bumps in the ground surface.

[0015] To this end, the present invention concerns an improved tower wagon which is equipped with a working platform which can be moved up and down and which is arranged on a mobile chassis, whereby the chassis of

the tower wagon is supported by a number of front wheels, a number of rear wheels and a number of intermediate wheels, whereby the tower wagon is provided with at least one swing arm having a front end, a rear end and a pivot shaft between both far ends, whereby the swing arm is hinge-mounted on the chassis at the pivot shaft so as to be able to hinge about the pivot shaft which is oriented transversely to the longitudinal direction or travel direction of the tower wagon so as to form a swing, and whereby intermediate wheels are mounted on the front end of the swing arm and rear wheels are mounted on the rear end of the swing arm.

[0016] A major advantage of such an improved tower wagon according to the invention consists in that its chassis is not only supported by front wheels and rear wheels, as is customary with the known tower wagons, but also by intermediate wheels, as a result of which an additional support of the chassis is obtained.

[0017] Another advantage of such an improved tower wagon according to the invention is that one or several swing arms are hinge-mounted on the chassis, which thus function as a kind of swing.

[0018] The swing arms may hereby rotate about a pivot shaft extending transversely to the longitudinal direction of the improved tower wagon.

[0019] Intermediate wheels and rear wheels are mounted on the front end and the rear end respectively of the swing arm or swing arms, so that when driving in pits or over bumps in the ground surface with such an improved tower wagon according to the invention, the swing arm or the swing arms may tilt so that the wheels can adjust to the pits or bumps in the ground surface there, while the working platform can be maintained stable and horizontally.

[0020] This contributes to the stability of a user present on the working platform and thus also to the safety.

[0021] In a preferred embodiment of an improved tower wagon according to the invention, every swing arm of the improved tower wagon is resiliently supported with respect to the chassis by means of press-on means.

[0022] Such press-on means are preferably formed of one or several gas pressure springs.

[0023] A major advantage of such an embodiment of an improved tower wagon according to the invention is that the intermediate wheels are always firmly pressed against the ground surface by means of the press-on means, such that they always have a good grip on the ground surface.

[0024] In another preferred embodiment of a tower wagon according to the invention, the intermediate wheels are driven wheels, which are being driven by an electric drive.

[0025] In combination with the above-mentioned characteristic that press-on means are each time provided between the chassis and the swing arm or swing arms, ensuring that the intermediate wheels are being pressed on the ground surface, an improved tower wagon according to the present embodiment guarantees that the im-

proved tower wagon can always be moved well, regardless of the presence of possible irregularities in the ground surface, since the driven intermediate wheels are properly pressed against the ground surface.

[0026] In order to better explain the characteristics of the invention, the following preferred embodiment of an improved tower wagon according to the invention is described by way of example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 is a side view of an improved tower wagon according to the invention, placed on a flat ground surface;

figure 2 is a side view of the improved tower wagon according to the invention from figure 1, placed on an uneven ground surface, whereby more particularly a local elevation, relief or bump is present in the ground surface;

figure 3 is a side view of the improved tower wagon according to the invention from figure 1, placed on an uneven ground surface, whereby in particular a local dip or pit is present in the ground surface;

figure 4 is a front view of the improved tower wagon according to the invention from figure 1, placed on an uneven ground surface, wherein the ground surface is more specifically such that the wheels of the tower wagon on its left-hand side are situated at a different height than the wheels on its right-hand side;

figure 5 is a side view on a larger scale of the portion of the improved tower wagon from figure 1 which is indicated by F5, more specifically the chassis and its supporting wheels;

figure 6 is a side view on a still larger scale of the portion from figure 5 which is indicated by F5, more specifically one of the swing arms with its supporting wheels;

figure 7 is a view in perspective of the same portion of the improved tower wagon which is illustrated in figure 6;

figure 8 is a bottom view of the improved tower wagon according to arrow F8 in figure 6; and,

figure 9 is a view in perspective of the same portion which is represented in figure 8.

[0027] The improved tower wagon 1 according to the invention represented in figures 1 to 9 is designed so as to be able to carry out works at a certain height H above a ground surface 2.

[0028] Typically, such an improved tower wagon 1 is designed to be used in horticulture, for example for taking care of plants or for building greenhouses and the like.

[0029] To this end, the improved tower wagon 1 is equipped with a working platform 3 which can be moved up and down, arranged on a mobile chassis 4.

[0030] In the embodiment as represented in the figures, the improved tower wagon 1 is designed as a scissor lift 1, whereby use is made in this case, for moving the working platform 3 up and down, of a double scissor mechanism 5 which consists of several slats, bars or rods 6 which are mutually hinge-mounted and which are moved in and out of each other by means of a controlled hydraulic cylinder 7.

[0031] Of course, it is not excluded according to the invention to apply other systems for moving the working platform 3 up and down.

[0032] To this end, use can be made for example of telescopic systems and the like.

[0033] The chassis 4 of the improved tower wagon 1 according to the invention is supported by a number of front wheels 8, a number of rear wheels 9 and a number of intermediate wheels 10.

[0034] As is represented in more detail in figures 8 and 9, more specifically four front wheels 8, four rear wheels 9 and four intermediate wheels 10 are provided in this case, each time mounted in pairs on either side of the improved tower wagon 1.

[0035] Save for a few nonessential details, the left portion 11 of the tower wagon 1 is a mirror image of the right portion 12 of the tower wagon 1 according to a vertical plane VV' through the centre of the tower wagon 1 extending in the longitudinal direction LL' thereof.

[0036] The front wheels 8 of the improved tower wagon 1 are swivelling front wheels 8, arranged in a rotatable manner around a vertical axis of rotation 13 on the chassis 4.

[0037] More specifically, in the case of the figures, the improved tower wagon 1 is provided with a pair of front wheels 8 on either side of the tower wagon 1, whereby each pair of front wheels 8 can individually swivel about a separate vertical axis of rotation 13.

[0038] Further, a sort of subframe or swing arm 14 is provided on the chassis 4 of the improved tower wagon 1 on either side 11 and 12, a sample of which is represented in more detail in figures 6 and 7.

[0039] Any such swing arm 14 has a front end 15, a rear end 16 and a pivot shaft 17 between these two ends 15 and 16.

[0040] The swing arms 14 are hinge-mounted on the chassis 4 at their pivot shaft 17 so as to be able to hinge about the pivot shaft 17 oriented in a direction BB' transversely to the longitudinal direction LL' or travel direction of the tower wagon 1.

[0041] Preferably, according to the invention, the pivot shaft 17 of a swing arm 14 is situated in the middle of the swing arm 14, wherein more specifically the horizontal distance X as of the axle or axles of the rear wheels 10 mounted on the swing arm 14 up to the pivot shaft 17 is equal to the horizontal distance Y as of the axle or axles of the intermediate wheels 10 mounted on the swing arm 14 up to the pivot shaft 17.

[0042] However, it is not excluded according to the invention to use other distances X and Y than those used in the illustrated examples.

[0043] A swing arm 14 contains a "horizontal" portion

18 which extends as of the rear end 16 up to a certain distance D as of the front end 15 of the swing arm 14 and which is directed horizontally when the tower wagon 1 is placed on a flat horizontal ground surface 2.

[0044] The remaining portion 19 of the swing arm 14 which extends as of the horizontal portion 18 is inclined downwards in the direction of the ground surface 2 up to the front end 15, and this remaining portion 19 is embodied as a sort of fork 19.

[0045] At this front end 15 of the swing arm 14 is mounted a pair of intermediate wheels 10, whereby one intermediate wheel 10 is provided in between the fork 19, and the other intermediate wheel 10 is mounted on the side thereof.

[0046] This is represented in more detail in figure 8.

[0047] On the rear end 16 of the swing arm 14 is mounted a pair of rear wheels 9.

[0048] These rear wheels 9, just like the front wheels 8, are swivelling wheels 9 which are rotatably mounted to this end around a vertical shaft 20 extending transversely to the horizontal portion 18 at the rear end 16 of the swing arm 14.

[0049] The advantage of such a configuration of a tower wagon 1 with swivelling front wheels 8 and swivelling rear wheels 9 is that the tower wagon 1, when driving straight ahead, can make a rotation about its central axis ZZ' by placing the rear wheels 9 and the front wheels 9 in a position BB' transversely to the normal travel direction LL'.

[0050] Thus, apart from a very stable driving performance, such a tower wagon 1 will also show a very high manoeuvrability.

[0051] Each swing arm 14 of the tower wagon 1 is resiliently supported with respect to the chassis 4 by means of press-on means 21.

[0052] In the figures, these press-on means 21 are in each case formed of a gas pressure spring 21.

[0053] These gas pressure springs 21 are hinge-mounted on the chassis 4 with one far end, and with their other far end they are hinge-mounted on a mounting plate 22 extending downward as of the horizontal portion 18, i.e. between the pivot shaft 17 and the front end 15 of the swing arm 14 rather in the direction of the intermediate wheels 10.

[0054] A gas pressure spring 21 is provided through an opening 23 in the horizontal portion 18 of the swing arm 14, so that a central positioning of the latter in the swing arm 14 is made possible.

[0055] In the case shown in the figures, the tower wagon 1 is provided with a pair of swing arms 14, more specifically a swing arm 14 on either side of the tower wagon 1, whereby half of the number of rear wheels 9 is mounted on said swing arm 14, as well as half of the number of intermediate wheels 10, and whereby each swing arm 14 can individually tilt around its pivot shaft 17.

[0056] Further, it should be noted that the intermediate wheels 10 are driven wheels, which are driven by an electric drive 24.

[0057] Each swing arm 14 is in this case provided with a separate drive 24 for driving the intermediate wheels 10 mounted on the swing arm 14 concerned.

[0058] Each drive 24 may consist of an electric motor 25 and a gear wheel transmission 26, as is the case in the figures, but all sorts of other configurations and drives 24 are possible in other embodiments.

[0059] Each swing arm 14 hereby forms a kind of swing which makes sure that, when driving over an unevenness in the ground surface 2, a downward movement of the intermediate wheels 10 is simultaneously accompanied by an upward movement of the rear wheels 9, or vice versa.

This is illustrated in figures 1 to 4.

[0060] In figure 1, the improved tower wagon 1 is situated on a flat and horizontal portion 27 of the ground surface 2.

[0061] Consequently, all the wheels, the front wheels 8, the rear wheels 9 and the intermediate wheels 10 rest on the same horizontal plane, whereby the portion 18 of the swing arms 14 effectively extends horizontally.

[0062] The working platform 3 is also oriented entirely horizontally.

[0063] Figure 2 illustrates what happens when the improved tower wagon 1 moves over a bump or elevation 28 in the ground surface 2.

[0064] At one point, the intermediate wheels 10 hereby rest on the top of the bump 28, whereas the rear wheels 9 simultaneously rest on a lower portion 29 of the ground surface 2.

[0065] To make this possible, the swings or swing arms 14 have tilted counterclockwise in figure 2 or according to arrow F, thus ensuring the contact of the driven intermediate wheels 10 and the rear wheels 9 with the ground surface 2.

[0066] Through the interaction of the front wheels 8, which are mounted directly on the chassis 4, and the rear wheels 9 and the intermediate wheels 10 which are mounted on the tilting swing arms 14, the working platform 3 remained nevertheless horizontal in this case as well.

[0067] Figure 3 illustrates the reverse situation, wherein the improved tower wagon 1 moves through a pit 29 or lower portion in the ground surface 2.

[0068] At one point, the intermediate wheels 10 hereby rest on the lower portion of the pit 29, whereas the rear wheels 9 simultaneously rest on a higher portion 28 or elevation in the ground surface 2.

[0069] To make this possible, the swings or swing arms 14 have tilted clockwise this time in figure 3 or according to arrow G, whereby the contact of the driven intermediate wheels 10 and the rear wheels 9 with the ground surface 2 is again always ensured.

[0070] Through the interaction of the front wheels 8, which are mounted directly on the chassis 4, and the rear wheels 9 and the intermediate wheels 10 which are mounted on the tilting swing arms 14, the working platform 3 remained once more horizontal in this case as well.

[0071] In short, moving with an improved tower wagon 1 according to the invention through pits 29 or over bumps 28 has little or no influence on the position of the working platform 3, which strongly contributes to the safety of the persons situated on the working platform 3.

[0072] Figure 4 illustrates a special situation wherein the left portion 11 of the tower wagon 1 moves over a flat and horizontal portion 27 of the ground surface 2, whereas the right portion 12 of the tower wagon 1 moves over an uneven portion of the ground surface 2 with an elevation 28 and a pit 29.

[0073] The swing arm 14 which is mounted on the left portion 11 of the chassis 4 does not tilt in this case, whereas the other swing arm 14 which is mounted on the right portion 12 of the chassis 4 is subjected to a tilting following the shape of the ground surface 2.

[0074] Thus, all the wheels 8, 9 and 10 always stay in contact with the ground surface 2, whereby a good grip is maintained and the tower wagon 1 can thus move on without any problems, while the working platform 3 is being held horizontally.

[0075] Thus, it is clear that with an improved tower wagon 1 according to the invention, a safe vehicle is obtained with which works at a height can be carried out in a very stable manner, and whereby the vehicle can be moved with great certainty.

[0076] The invention is by no means restricted to the embodiments of an improved tower wagon 1 according to the invention described by way of example and illustrated in the accompanying drawings; on the contrary, such an improved tower wagon 1 can be achieved in other ways while still remaining within the scope of the invention.

Claims

1. Improved tower wagon (1) which is equipped with a working platform (3) which can be moved up and down, arranged on a mobile chassis (4), **characterised in that** the chassis (4) of the tower wagon (1) is supported by a number of front wheels (8), a number of rear wheels (9) and a number of intermediate wheels (10), whereby the tower wagon (1) is provided with at least one swing arm (14) having a front end (15), a rear end (16) and a pivot shaft (17) between both far ends (15,16), whereby the swing arm (14) is hinge-mounted on the chassis (4) at the pivot shaft (17) so as to be able to hinge about the pivot shaft (17) oriented transversely to the longitudinal direction (LL') or travel direction of the tower wagon (1) so as to form a swing (14), and whereby intermediate wheels (10) are mounted on the front end (15) of the swing arm (14) and rear wheels (9) are mounted on the rear end (16) of the swing arm (14), whereby the tower wagon (1) is provided with a pair of swing arms (14), more specifically a swing arm (14) on either side (11,12) of the tower wagon

(1), whereby half of the number of rear wheels (9) is mounted on each swing arm (14), as well as half of the number of intermediate wheels (10), and whereby each swing arm (14) can tilt individually around its pivot shaft (17).

2. Improved tower wagon (1) according to claim 1, **characterised in that** each swing arm (14) of the tower wagon (1) is resiliently supported with respect to the chassis (4) by means of press-on means (21).
3. Improved tower wagon (1) according to claim 2, **characterised in that** the press-on means (21) are formed of one or several gas pressure springs (21).
4. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** the front wheels (8) are swivelling front wheels (8), whereby these front wheels (8) are arranged in a rotatable manner around a vertical axis of rotation (13) on the chassis (4).
5. Improved tower wagon (1) according to claim 4, **characterised in that** the tower wagon (1) is provided with a pair of front wheels (8) on either side (11,12) of the tower wagon (1), whereby each pair of front wheels (8) can individually swivel about a separate vertical axis of rotation (13).
6. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** the rear wheels (9) are swivelling rear wheels (9), whereby these rear wheels (9) are arranged in a rotatable manner around a vertical axis of rotation (20) on the respective far end (16) of the respective swing arm (14).
7. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** a pair of rear wheels (9) is in each case provided on the rear end (16) of the swing arm or swing arms (14).
8. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** the intermediate wheels (10) are driven wheels, which are driven by a drive (24).
9. Improved tower wagon (1) according to claims 1 and 8, **characterised in that** at each swing arm (14) is provided a separate electric drive (24) for driving the intermediate wheels (10) which are mounted on the respective swing arm (14).
10. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** a pair of intermediate wheels (10) is in each case provided on the front end (15) of the swing arm (14) or swing arms (14).

11. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** the pivot shaft (17) of a swing arm (14) is situated in the middle of the swing arm (14), whereby more specifically the horizontal distance (X) as of the axle or axles of the rear wheels (9) mounted on the swing arm (14) up to the pivot shaft (17) is equal to the horizontal distance (Y) as of the axle or axles of the intermediate wheels (10) mounted on the swing arm (14) up to the pivot shaft (17). 5 10
12. Improved tower wagon (1) according to one or several of the preceding claims, **characterised in that** by placing the rear wheels (9) and the front wheels (8) in a position (BB') transversely to the normal travel direction (LL'), the tower wagon (1), when driving straight ahead, can rotate about its central axis (ZZ'). 15

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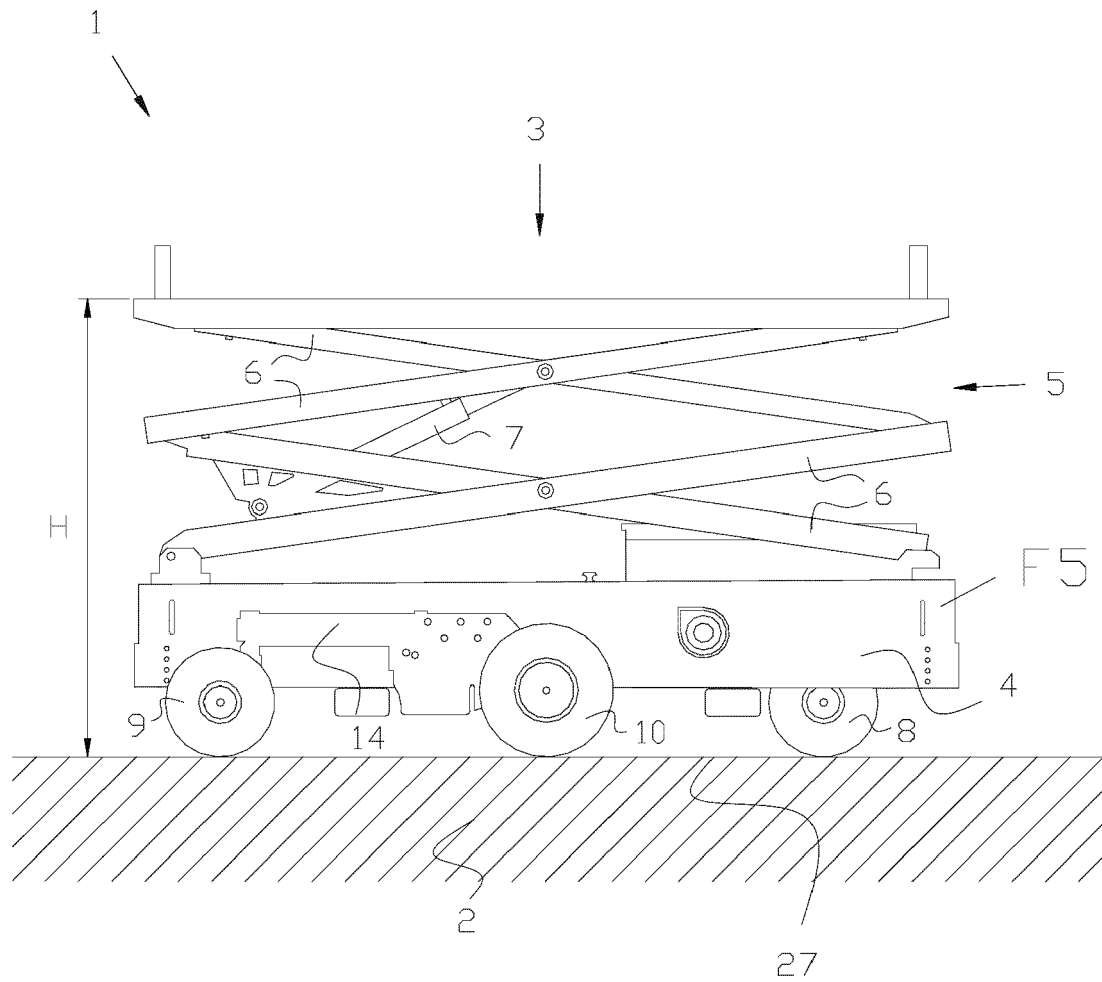


FIG 1

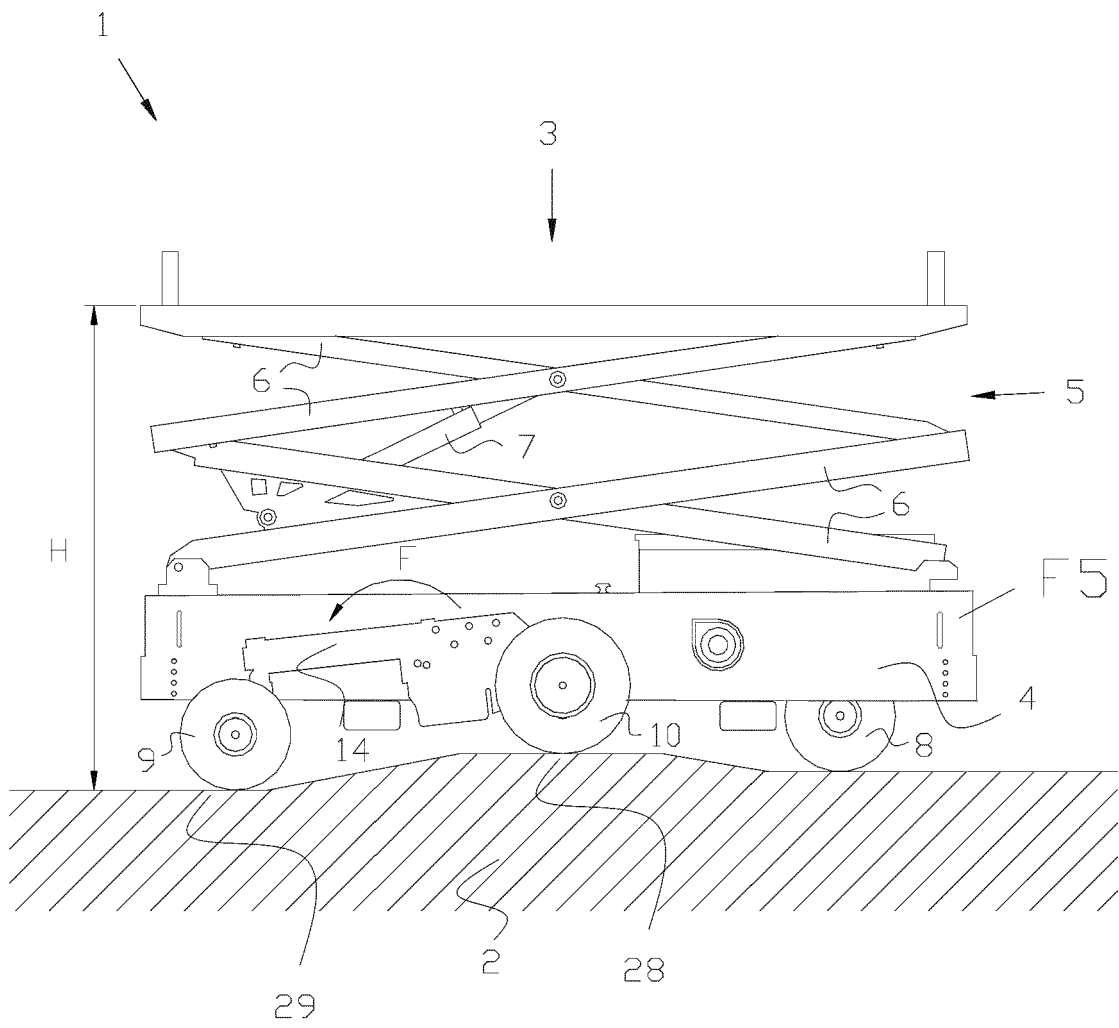


FIG 2

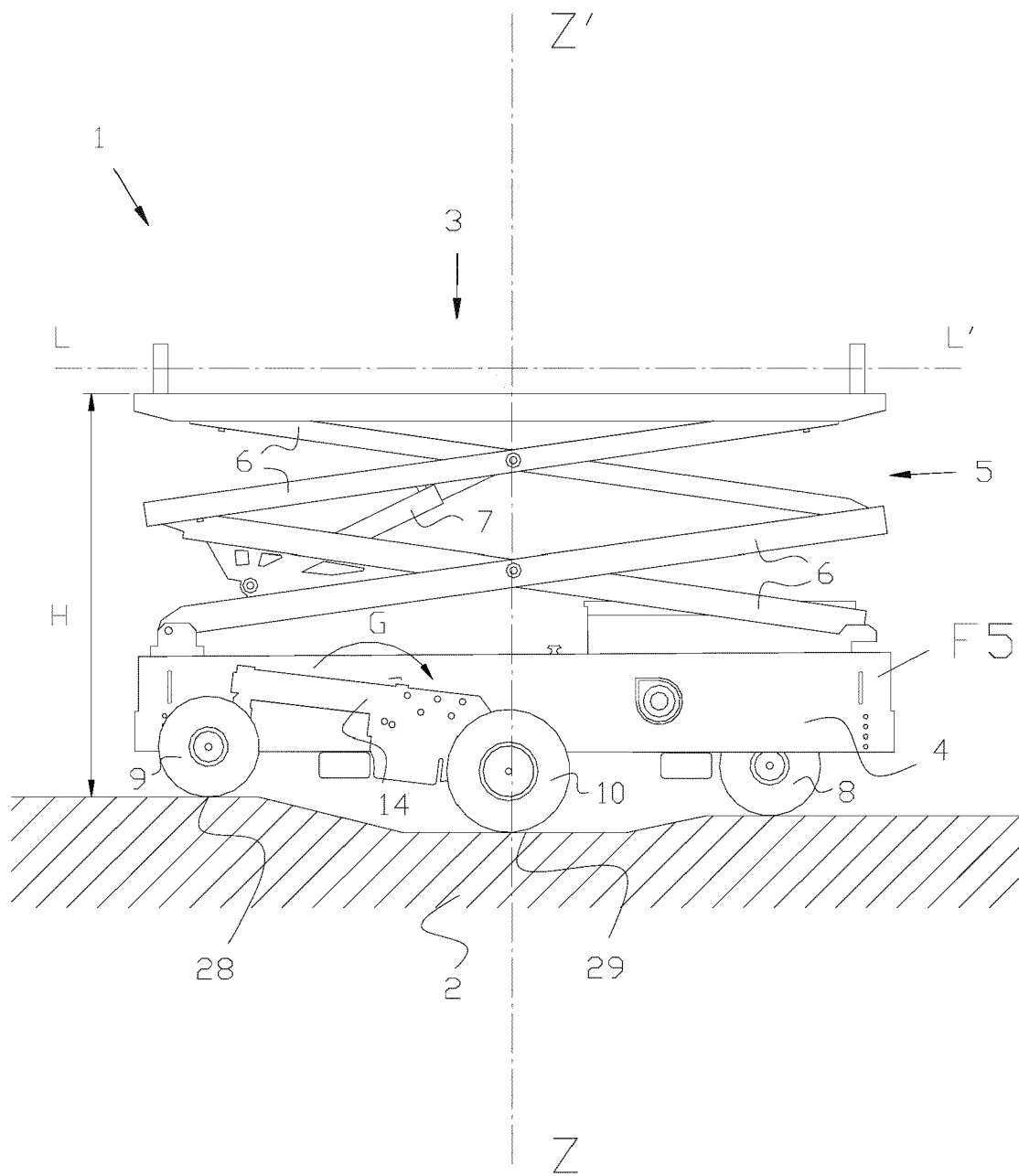


FIG 3

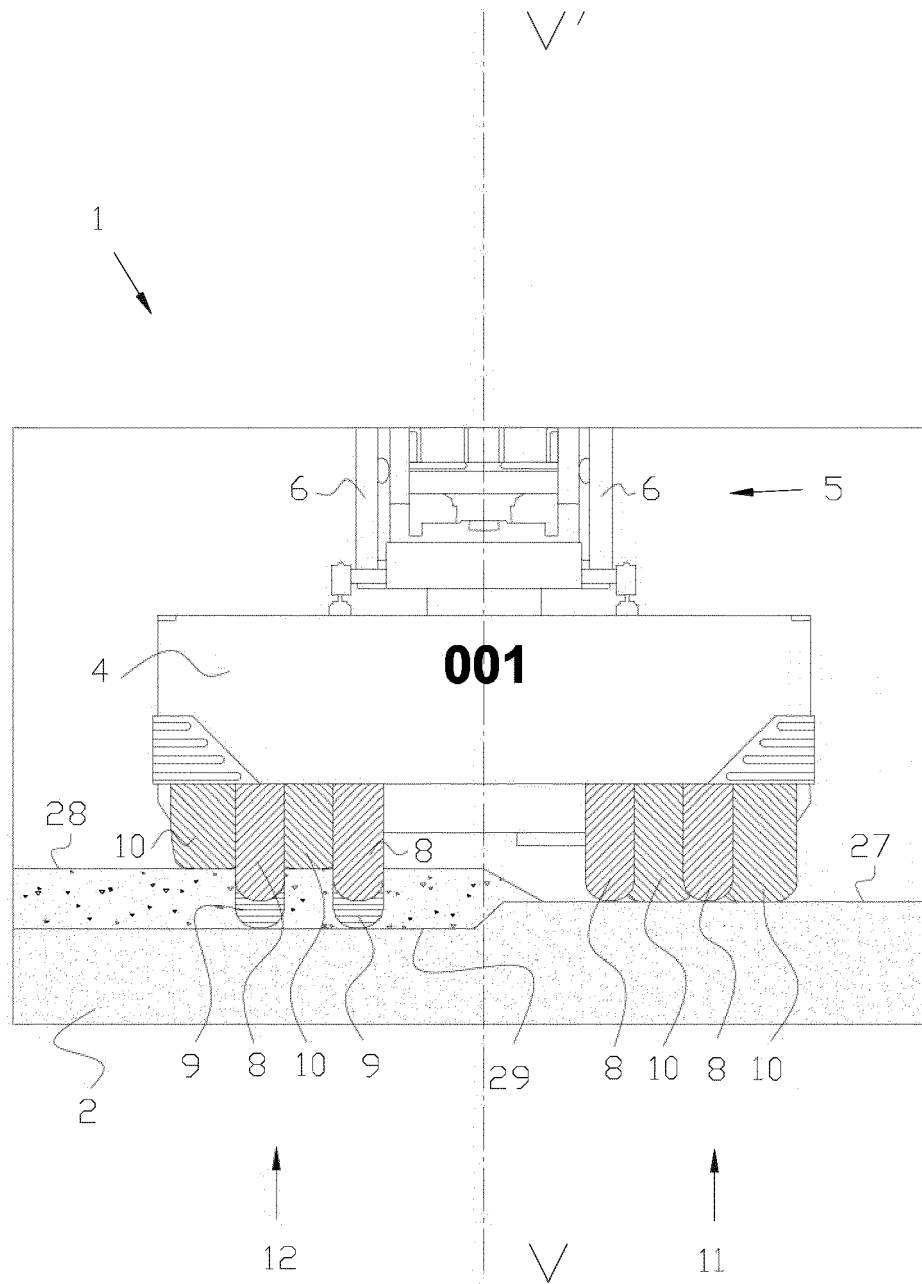


FIG 4

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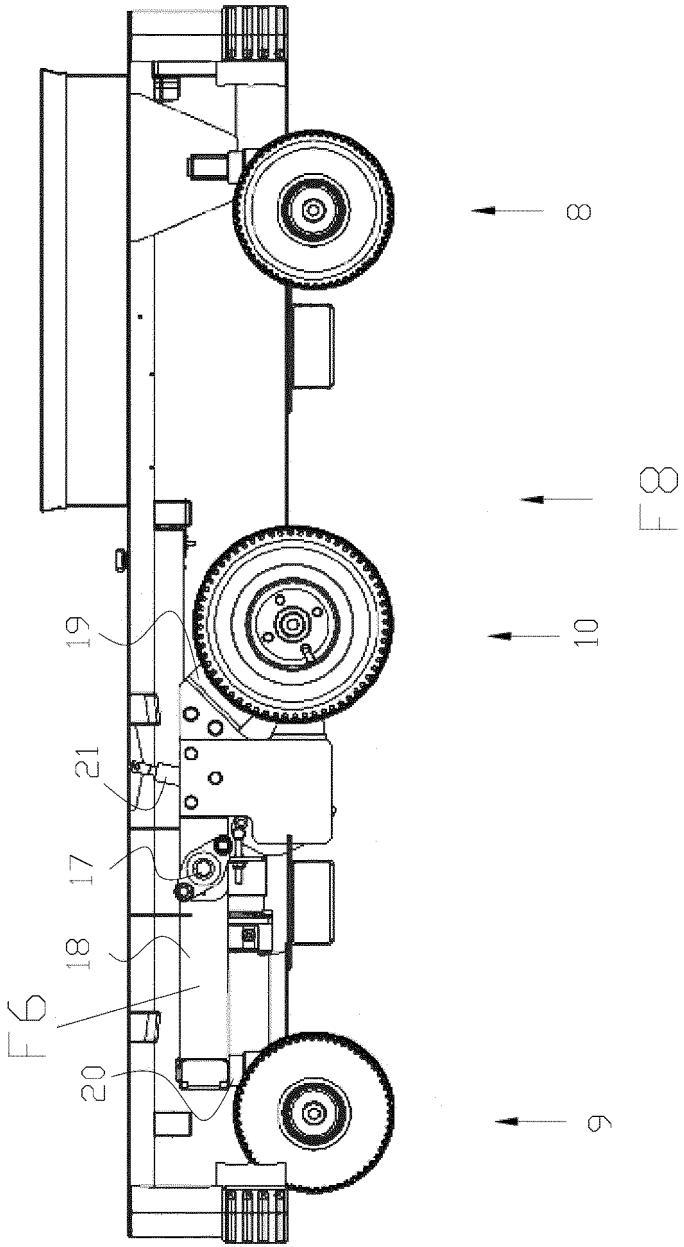
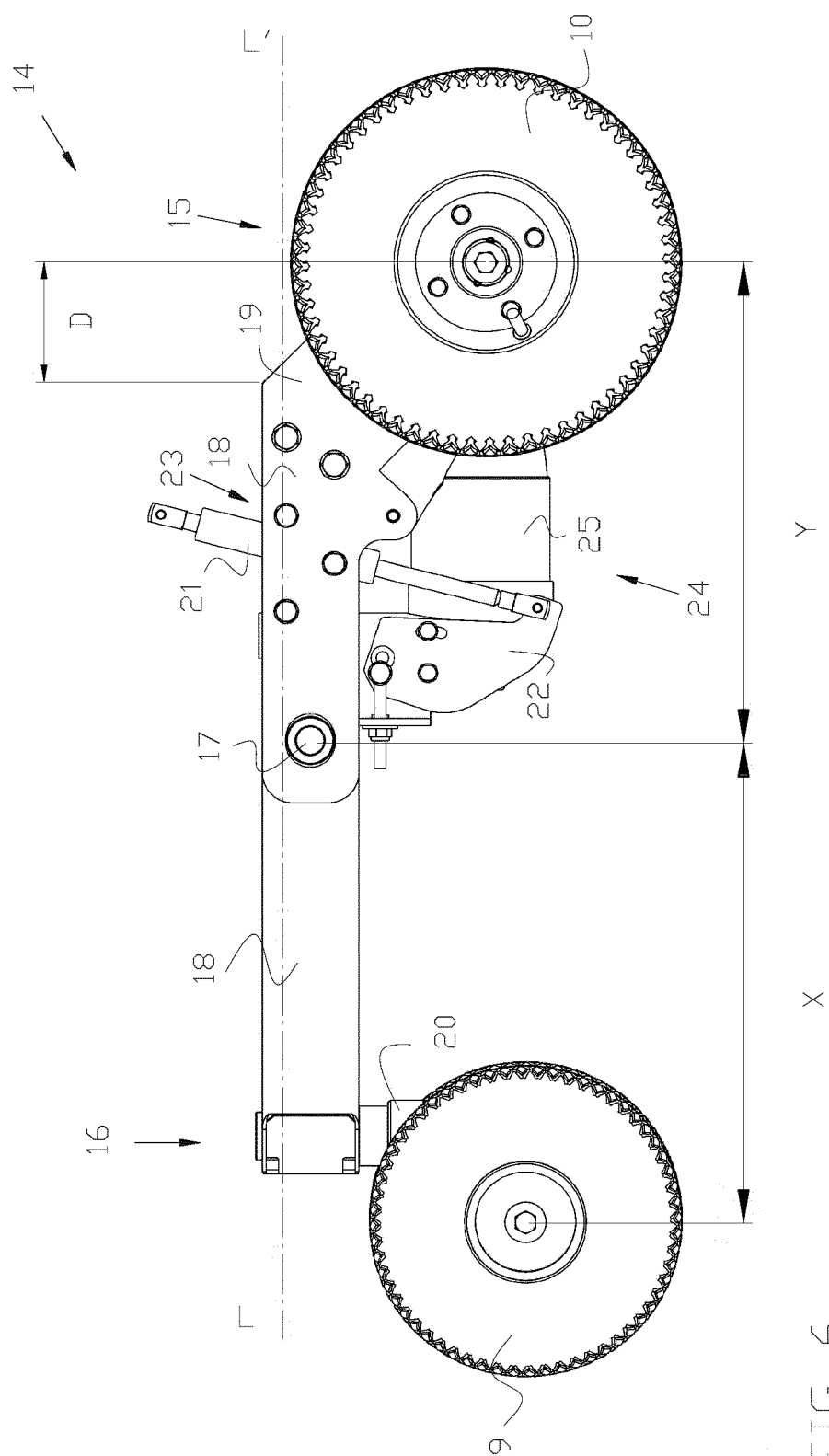


FIG 5



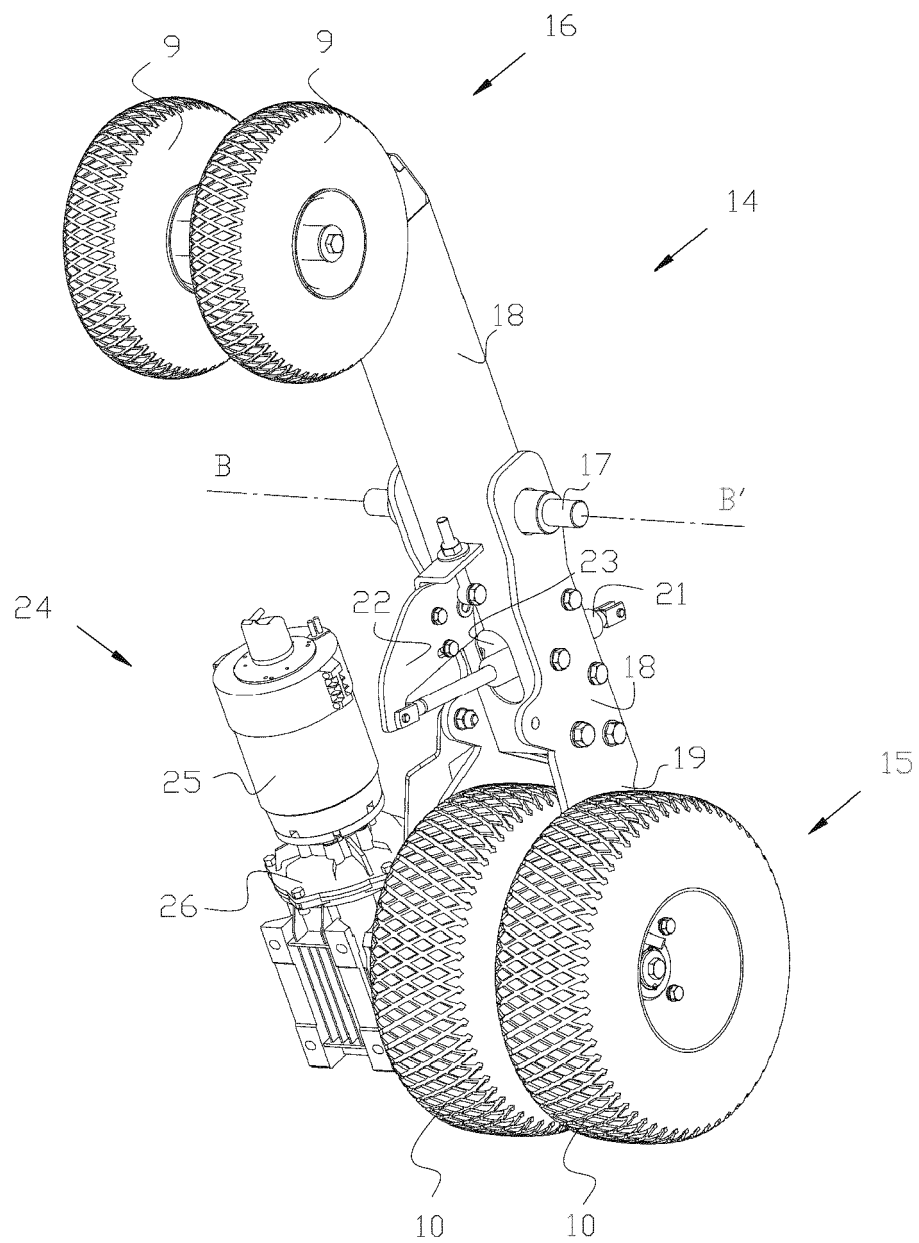


FIG 7

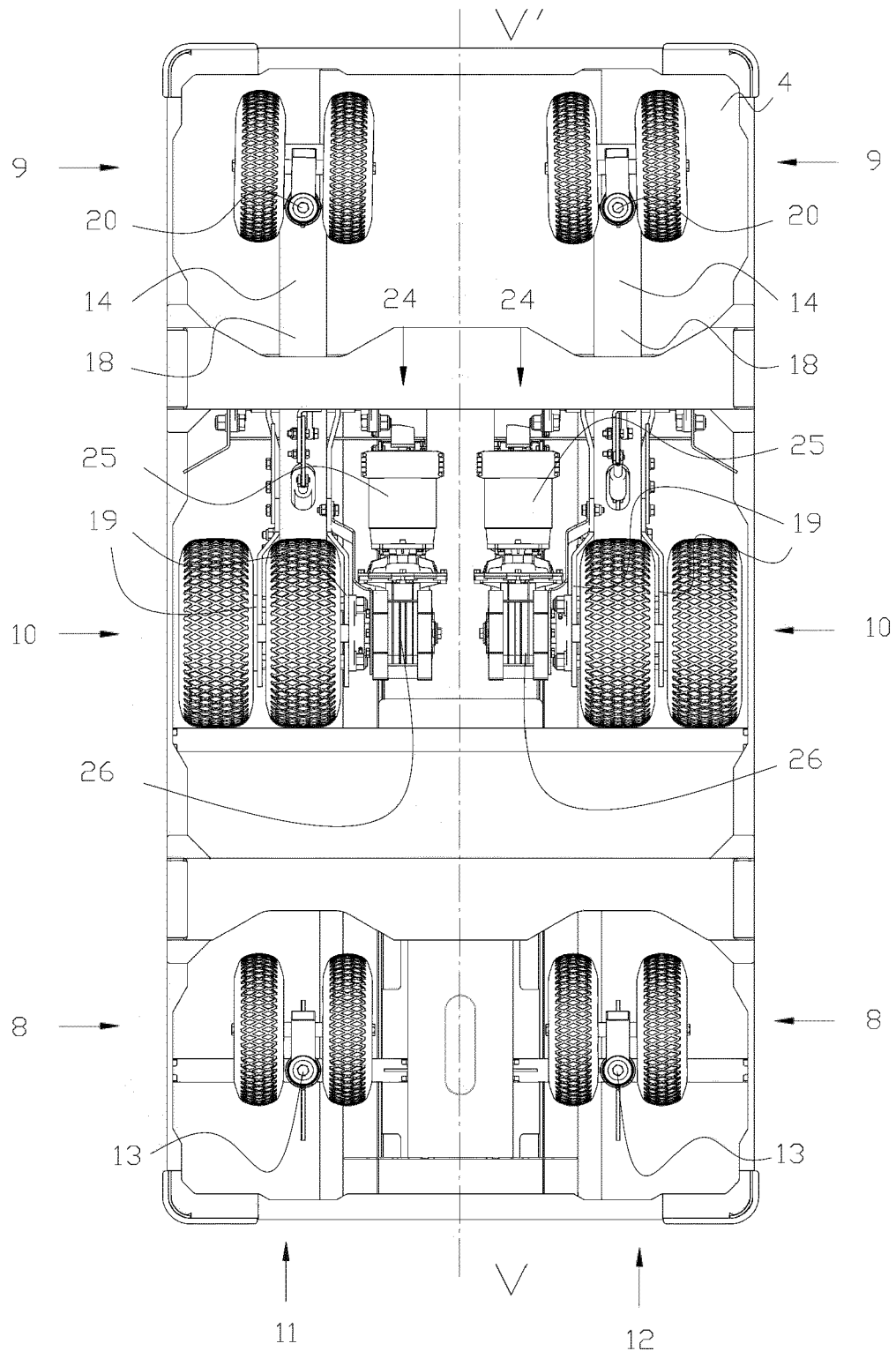


FIG 8

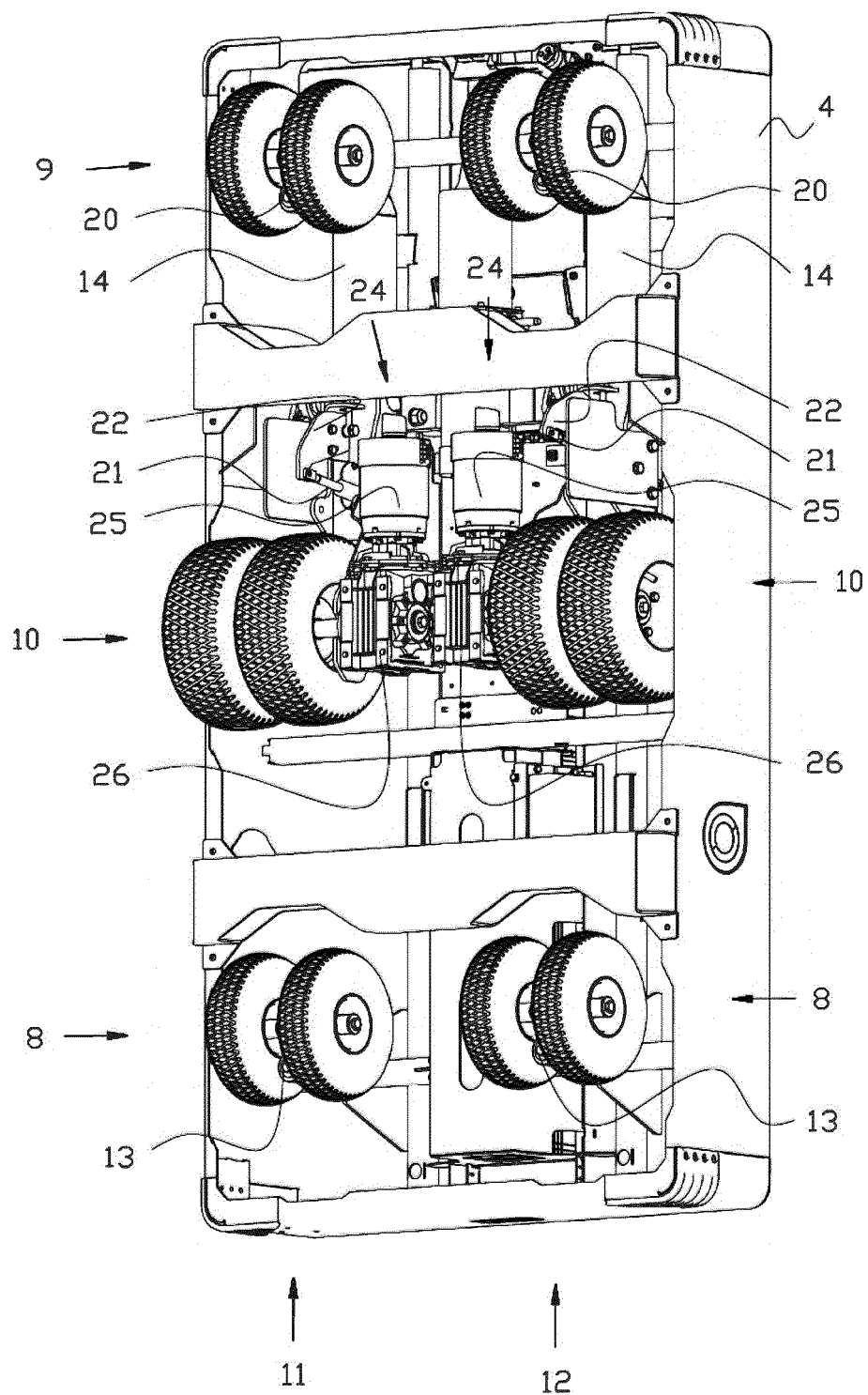


FIG 9



EUROPEAN SEARCH REPORT

 Application Number
EP 17 15 4120

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 23 June 2017	Examiner Verheul, Omiros
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 15 4120

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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