(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 974 372 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.03.2022 Bulletin 2022/13

(21) Application number: **21197918.2**

(22) Date of filing: **21.09.2021**

(51) International Patent Classification (IPC):
B66F 11/04 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66F 11/046

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **28.09.2020 IT 202000022831**

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(54) MOBILE ELEVATING WORK PLATFORM

(57) A mobile elevating work platform (10) which comprises:
- a self-propelled base frame (20);
- an elevating arm (60), one first end of which is jointed to the base frame (20) and one second opposite free end of which is adapted to be fixed to an operating assembly (70);
- a plurality of stabilisers (25) associated to the base frame (20) each of which is alternatively mobile between a working position, wherein it is laid on the ground, and a rest position, wherein it is lifted from the ground;
- a pair of longitudinal track assemblies (31,32) opposite with respect to the base frame (20) to lay it on the ground,
- a pair of movement assemblies (33,34), wherein each movement assembly is configured to move a respective track assembly (31,32) relative to the base frame (20), between a position approached to the base frame (20) and a position moved away from it, wherein each movement assembly (33,34) comprises at least a support rod (331,341) supporting at a first end (3310,3410) the respective track assembly (31,32),

characterized in that a second end (3311,3411) of the support rod (331,341) opposite to the first end (3310,3410) of each movement assembly (33,34) is configured to be at least partially comprised in the lateral plan size of the opposite track assembly (31,32) when both track assemblies (31,32) are in the respective approached position.

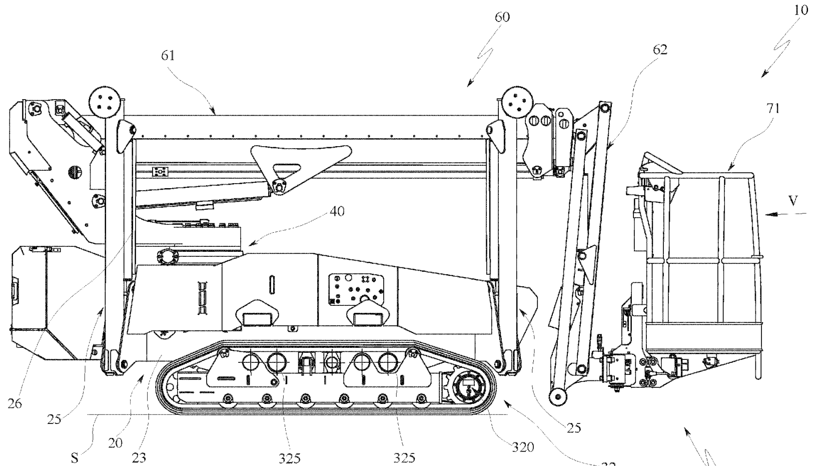

FIG.1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a mobile elevating work platform (AWP).

[0002] More specifically, a mobile elevating work platform, also known as an aerial work platform, tracked and stabilised, i.e., provided with stabilisers.

PRIOR ART

[0003] As is well known, mobile stabilised elevating work platforms (AWPs), commonly referred to as "Spiders", are essentially platforms classified, according to European, Canadian, US and Australian regulations (EN280, NSI/SAIA A92.20-2018, CAN/CSA -B354.6:17, AS/NZS 1418.10:2011) as Group B and Type 1.

[0004] In particular, they are mobile elevating work platforms, usually tracked, in which, during operation at height of the basket, the vertical projection of the centre of gravity of the basket may extend beyond the tipping line of the frame.

[0005] Therefore, apart from their transport configuration, in which the arm supporting the basket is centred along the longitudinal axis of the tracks and retracted, i.e. with the basket placed at a minimum height above the ground (which may not exceed 3 m in height), these machines may be used to lift the basket to the desired working height only after they have been suitably stabilised, i.e., only after all the stabilisers (generally four in number) have been brought into contact with the ground and the frame supporting the arm has been levelled.

[0006] The purpose of the stabilisers in these known machines is to extend the ground support area, for example in the lateral direction, so that the lateral size occupied by the stabilised machine, i.e., by the stabilisers when extended, is comprised between 2.5 m and about 4 m.

[0007] In this way, it is possible to ensure that the plan projection of the basket raised to the working height remains within the tipping area of the machine (preventing unwanted tipping thereof) and, at the same time, it is possible to guarantee sufficient working mobility for the basket (within a permitted working volume that is a function, among other things, of the width of the lateral size defined by the ground stabilisers).

[0008] Moreover, almost all the machines of this type known on the market, according to the requirements of manufacturers and users, are designed so that (under transport conditions and with the basket dismounted) they can pass through a door with standard dimensions (i.e., with a minimum width of 800mm).

[0009] This design constraint requires manufacturers of this type of machines to produce stabilised mobile elevating work platforms, which in their transport configuration (and with the basket dismounted) and in their minimum size have a maximum permissible width (or transverse dimension to the longitudinal axis of the tracks) that does not exceed 790mm.

[0010] Such a reduced minimum size means that the wheel track width (i.e. the lateral size of the tracks) can, at most, be varied from a minimum value equal to the aforesaid maximum width (i.e. equal to 790 mm) to a maximum value that, due to the technical limitation of the mechanical configurations currently available on the market, does not exceed a 50% increase with respect to the aforesaid maximum width, i.e. is less than or equal to 1180 mm.

[0011] A need felt in the sector is that of increasing the potential use and the admissible performances of this type of machines.

[0012] An object of the present invention is to satisfy these needs and others of the prior art, within the framework of a simple, rational and low cost solution.

[0013] Such objects are achieved by the characteristics of the invention given in the independent claim. The dependent claims outline preferred and/or particularly advantageous aspects of the invention.

DISCLOSURE OF THE INVENTION

[0014] The invention, in particular, makes available a mobile elevating work platform which comprises:

- a self-propelled base frame;
- an elevating arm, one first end of which is jointed to the base frame and one second opposite free end of which is adapted to be fixed to an operating assembly;
- a plurality of stabilisers associated to the base frame each of which is alternatively mobile between a working position, wherein it is laid on the ground, and a rest position, wherein it is lifted from the ground;
- a pair of longitudinal track assemblies opposite with respect to the base frame to lay it on the ground,
- a pair of movement assemblies, wherein each movement assembly is configured to move a respective track assembly relative to the base frame, between a position approached to the base frame and a position moved away from it, wherein each movement assembly comprises at least a support rod supporting at a first end the respective track assembly,

characterized in that a second end of the support rod opposite to the first end of each movement assembly is configured to be at least partially comprised in the lateral plan size of the opposite track assembly when both track assemblies are in the respective approached position.

[0015] Thanks to this solution, the above-mentioned aims can be achieved.

[0016] In particular, thanks to this solution it is possible to determine for the track assemblies a contraction extra-stroke towards the base frame that allows them to reach a very limited minimum track width (for example 790 mm) that allows the platform to pass through standard doors or access points (800 mm), but at the same time allows to determine for the track assemblies an extraction extra-stroke moved away with respect to the base frame that allows them to obtain a very wide maximum wheel track width (wider than the group B and type 1 platforms known on the market).

[0017] This enlarged maximum wheel track width, among other things, allows the platform to be used in operating conditions other than the transport configuration, unlike the known group B type 1 platforms, in fact, by increasing the ground support area defined by the track assemblies (in their enlarged position) it is possible to increase the stability area (anti-tip) of the platform even when the stabilisers are in their rest position (i.e. lifted from the ground).

[0018] Therefore, thanks to this increase in the maximum wheel track width, it is possible to raise the elevating arm (by moving it considerably from the transport configuration) in order to bring it into appropriate working configurations (e.g. at heights greater than 3 m), without having to bring the stabilisers into their working position (i.e. keeping them in the rest position) while remaining under safe conditions, as the arm is allowed to be lifted so as not to unbalance the platform with respect to the increased stability area defined by the (only) track assemblies.

[0019] It has also been observed that these conditions of safe platform stability (due to the aforesaid configuration of the track assemblies and the movement assemblies) can be maintained both when the ground on which the track assemblies lay is horizontal and when the ground is inclined with respect to the horizontal, for example, by a first angle ($\pm$ 10°) in the longitudinal direction with respect to the longitudinal axis of the track assemblies and by a second angle ($\pm$ 5°), less than the first angle, in the transverse (or lateral) direction with respect to the longitudinal axis of the track assemblies.

[0020] Furthermore, thanks to this, the platform is allowed (always with the stabilisers in the rest position) to advance or be moved on the track assemblies (with the elevating arm raised above 3 metres) while maintaining the aforesaid stability in safety on both horizontal grounds and inclined grounds, as described above.

[0021] Advantageously, each track assembly may comprise a housing seat configured to house therein at least an end tract provided with the second end of the support rod supporting the opposite track assembly.

[0022] Again, each movement assembly may comprise at least a support metal pipe rigidly fixed to the base frame and provided with:

- a first end that is proximal and facing the respective track assembly;
- an opposite open second end; and
- a longitudinal pass-through cavity which puts the first end and the second end in communication;

the support rod of each movement assembly is slidably housed at least partially inside the longitudinal cavity of the respective support pipe and is mobile between two axial end-stop positions, of which

a first end-stop position, wherein the second end of the support rod is flush or protrudes axially out of the longitudinal cavity at the second end side thereof and the respective track assembly supported by the first end of the support rod is in its approached position, and

a second end-stop position, wherein the second end of the support rod is axially placed inside the longitudinal cavity (e.g., proximal to the first end thereof) and the respective track assembly supported by the first end of the support rod is in its moved-away position.

[0023] According to an aspect of the invention, each movement assembly may comprise an actuator configured to move the respective track assembly alternatively between the approached position and the moved-away position.

[0024] Furthermore, the elevating mobile work platform may comprise a powered fifth wheel supported at the top to the base frame and rotatable relative to a rotation axis, the first end of the elevating arm being jointed to the fifth wheel relative to an articulation axis orthogonal to the rotation axis of the fifth wheel.

[0025] Advantageously, the mobile elevating work platform may further comprise a first driving assembly configured to drive the tilting of the elevating arm about its articulation axis and/or a second driving assembly configured to drive the extension of the elevating arm. According to a preferred aspect of the invention, when both track assemblies are in the moved-away position the platform may have a maximum wheel track width increased of a percentage between 50% (excluded) and 90%, preferably between 70% and 85%, more preferably of 76%, with respect to a minimum wheel track width as defined when both track assemblies are in the approached position.

[0026] Again, each track assembly may have a length higher than 1.5 m, preferably higher than 2 m.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Further features and advantages of the invention will be more apparent after reading the following description provided by way of non-limiting example, with the aid of the accompanying drawings.

Figure 1 is a side view (under transport conditions) of an elevating work platform according to the invention.

Figure 2 is a rear elevation view of Figure 1 (with the track assemblies in an approached position).

Figure 3 is a rear elevation view of the platform in Figure 1, with the track assemblies in a moved-away position.

Figure 4 is a side view of a base frame of the platform according to the invention with the track assemblies in an approached position.

Figures 5A, 5B and 5C are cross-sectional views of sectional traces A-A, B-B and C-C of Figure 4, respectively.

Figure 6 is a side view of a base frame of the platform according to the invention with the track assemblies in a moved-away position.

Figures 7A, 7B and 7C are cross-sectional views of sectional traces G-G, H-H and I-I of

Figure 6, respectively.

Figure 8 is a front view of the platform in Figure 1 laid on a ground inclined laterally by 5°, with the elevating arm in a permissible high working position (with the stabilisers in the rest position).

Figures 9A and 9B are side views of the platform of Figure 1 laid on a ground inclined longitudinally by +10° and -10° respectively, with the elevating arm in a permissible high working position (with the stabilisers in the rest position).

Figure 10 is a schematic view of a platform control system according to the invention.

Figure 11 is a flow diagram of a control cycle of the operation of the platform according to the invention.

Figure 12 is a side view of a base frame of the platform according to a further embodiment of the invention.

Figures 13A and 13B are sectional views, respectively, of the sectional traces A-A and B-B of Figure 12, with the track assemblies in approached position.

Figures 14A and 14B are sectional views, respectively, of the sectional traces A-A and B-B of Figure 12, with the track assemblies in the moved-away position.

BEST MODE OF THE INVENTION

[0028] With particular reference to these figures, an elevating work platform (AWP), more specifically, a mobile elevating work platform, also known as an aerial work platform, tracked and stabilised, e.g., of the self-propelled type, is globally referred to as 10.

[0029] The platform 10 comprises a base frame 20, which for example is defined by a substantially parallelepiped (rigid) body, for example with an elongated base along a longitudinal axis, for example rectangular in shape, preferably contained in a casing.

[0030] The base frame 20 comprises, for example, a lower surface 21 intended to face the ground S, in operation, an opposite upper surface 22 facing upwards, two longitudinal sidewalls 23, one of which is right and one is left, and two opposite heads, one of which is front and one is rear (in the advancement direction of the platform 10 on the ground S).

[0031] In the present discussion, by right and left, respectively, it is intended the right and left side of the platform 10 with respect to a front anterior view thereof according to the direction V of Figure 1.

[0032] The platform 10 further comprises at least one pair of powered track assemblies 31,32 associated on opposite sides of the base frame 20 to lay it on the ground S.

[0033] In practice, the track assemblies 31,32 define the ground support S of the platform 10 (keeping the base frame 20 suspended) and allow the movement thereof on the ground S.

[0034] In the preferred embodiment shown in the figures, each of the track assemblies 31 and 32 is, preferably, powered independently of each other.

[0035] Preferably, the platform 10 comprises a right track assembly 31 and a left track assembly 32, each of which is individually associated to the base frame 20, for example movably with respect thereto, as will be better described below. In particular, by right and left it is meant a specular arrangement with respect to the longitudinal median plane of the base frame 20 orthogonal to the upper surface 22 thereof (e.g., with respect to an advancement or backward direction imposed by the elements of support 30 to the same platform on the ground).

[0036] The right track assembly 31 is, therefore, proximal (and parallel) to the right sidewall 23 and the left track assembly 32 is proximal (and parallel) to the left sidewall 23.

[0037] Each track assembly 31 and 32, in particular, comprises a train of sprockets, at least one of which is driven by a respective motor 310 and 320, adapted to drive in rotation a flexible member closed on itself into a ring, for example made of rubber, the lower branch of which defines a (large) longitudinal ground support surface S. In practice, the longitudinal ground support surfaces S of the track assemblies 31 and 32 are coplanar with each other and, preferably, are placed at a lower level than the lower surface of the base frame 20.

[0038] The train of sprockets is at least partially contained and supported between two side containment walls, of which an inner side wall 311 and 321 (facing, parallel to and at a distance from the sidewall 23 proximal thereto) and an outer side wall 312 and 322. The side containment walls are joined together at their top by an upper containment wall (squared with them).

[0039] In practice, the side containment walls and the upper containment wall define a substantially box-like longitudinal body (with an inverted "U" section) open at the bottom.

[0040] A powered main pinion (keyed on the drive shaft of the respective motor 310,320) and a driven main pinion are rotatably associated with the opposite ends of the longitudinal body (around respective rotation axes).

[0041] The powered main pinion and the driven main pinion project (inferiorly and axially) from the longitudinal body.

[0042] The inner side wall 311 and 321 and the outer side wall 312 and 322 of each track assembly 31 and 32 are surrounded along the perimeter by the respective flexible member.

[0043] The flexible member of each track assembly 31,32 has an upper branch (substantially parallel to the lower branch) which is placed at a height above the ground substantially equal to the height above the ground of the top of the upper surface 22 of the base frame 20 (i.e., the sidewalls 23 thereof).

[0044] For example, the flexible member of each track assemblies 31,32 is wound on itself into a substantially trapezoidal (isosceles trapezoid) annular shape, in which the major base is defined by the lower branch (whose vertices are defined at the main pinions) and the minor base is defined by the upper branch (whose vertices are defined by two return pinions which are rotatably coupled to two respective ears fixed at the top to the upper containment wall of the containment body).

[0045] The inner side wall 311 and 321, as well as the outer side wall 312 and 322 of each track assembly 31 and 32 are substantially rectangular in shape (and are included within the ring defined by the flexible member). As shown schematically in Figure 12 (but it can also be provided in the platform of Figure 6), on each longitudinal body of each track assembly 31 and 32 (i.e., in each inner side wall 311 and 321 and each outer side wall 312 and 322) two fork seats F are made (aligned with respective fork seats obtained in the other longitudinal body).

[0046] Each fork seat F is made from a through slot (closed on the perimeter).

[0047] Thanks to the fork seats F, the platform 10 can be transported/displaced/loaded by means of a forklift vehicle.

[0048] The fork seats F are arranged (as a whole) at a lower height than the height of the lower surface 22 of the base frame 20.

[0049] The longitudinal axis of the longitudinal support surface defined by each track assembly 31 and 32 is substantially parallel to the prevailing direction of the base frame 20 (i.e., the longitudinal axis A) and defines the advancement or backward direction (in a straight line) of the platform 10.

[0050] Preferably, the length of the longitudinal support surface of each track assembly 31 and 32 is substantially equal to (for example, slightly greater than) the prevailing dimension of the base frame 20.

[0051] Thanks to the track assemblies 31 and 32, the platform 10 is laying on the ground S on a pair of large longitudinal surfaces, defined by the lower branches of the flexible members, which extend along the whole length of the base frame 20 (and beyond) and are transversely spaced apart by an interaxle spacing greater than the width (smaller dimension) of the base frame 20.

[0052] This allows the weight of the whole platform 10 and any associated loads to be distributed evenly, as will be seen below, ensuring an adequate stability even on sloping and/or deformable terrains (such as earth or sand).

[0053] For example, the width of the longitudinal support surface of each track assembly 31 and 32, obtained from the product between the length of the track assembly and the width of the track assembly, is substantially between 1000 and 8000 cm^2, preferably substantially equal to 3900 cm^2.

[0054] For example, each track assembly has a length substantially between 1500 mm and 2500 mm, preferably between 2000 mm and 2300, for example equal to 2150 mm. Preferably, each track assembly 31 and 32 comprises at least one housing seat 315 and 325, for example open at least at the inner side wall 311 and 321 (and open or closed at the outer side wall 312 and 322).

[0055] For example, each track assembly 31 and 32 comprises a plurality of housing seats 315 and 325, in particular two in number.

[0056] Each housing seat 315 and 325 has an elongated shape along a longitudinal (straight) axis parallel to the rotation axis of the train of sprockets of the respective track assembly 31 and 32.

[0057] For example, each housing seat 315 and 325 can be substantially cylindrical or prismatic in shape.

[0058] In the example, each housing seat 315 and 325 has a substantially prismatic shape (with a trapezoidal base).

[0059] In the example, each housing seat 315 and 325 is arranged at the top of the upper containment wall of the containment body of the respective track assembly 31 and 32 and below the upper branch of the flexible member of the respective track assembly 31 and 32.

[0060] In detail, each housing seat 315 and 325 is delimited at the bottom by the upper containment wall of the containment body of the respective track assembly 31 and 32, at the top by an upper branch of the flexible member of the respective track assembly 31 and 32.

[0061] Furthermore, each housing seat 315 and 325 can be laterally delimited, for example by an ear protruding from the upper containment wall or be open laterally.

[0062] Overall, each housing seat 315 and 325 is placed at a higher height than the height of the rotation axes of the main pinions.

[0063] Thanks to this, the housing seat 315 and 325 does not weaken the structural integrity of the longitudinal body and, at the same time, (as can be understood in the following) it allows to have a high distance above the ground of the lower surface 22 of the base frame 20 (with undoubted advantages of practicability of uneven terrain by the platform 10).

[0064] Each housing seat 315 and 325 comprises a first open end made/defined at the inner side wall 311 and 321 and an opposite second end, e.g., closed, made/defined at the outer side wall 312 and 322 of the respective track assembly 31 and 32.

[0065] In the example shown, each housing seat 315 and 325 comprises a first open end made/defined at the inner side wall 311 and 321 and an opposite second end, also open, made/defined at the outer side wall 312 and 322 of the respective track assembly 31 and 32.

[0066] The platform 10 further comprises a pair of movement assemblies 33 and 34, wherein each movement assembly 33 and 34 is configured to move a respective track assembly 31 and 32 relative to the base frame 20, alternatively, between a (its own) position approached to the base frame 20 and a (its own) position moved away from the base frame.

[0067] Preferably, each movement assembly 33 and 34 is configured to slide (i.e., translate) the respective track assembly 31 and 32 so that it remains parallel to itself during motion.

[0068] Preferably, the platform 10 comprises a right movement assembly 33 configured to support and move the right track assembly 31 and a left movement assembly 34 configured to support and move the left track assembly 32, each of which is individually associated with the base frame 20.

[0069] In practice, each track assembly 31 and 32 is individually movably associated with respect to the base frame 20 by means of a respective movement assembly 33 and 34, for example, slidably (remaining parallel to itself), between the respective approached (end) position, wherein the respective track assembly 31 and 32 is proximal to the base frame 20 (i.e. to the respective sidewall 23), and the (end) moved-away position, wherein the respective track assembly 31 and 32 is distal from the base frame 20 (i.e. to the respective sidewall 23), and each intermediate position therebetween.

[0070] Each movement assembly 33 and 34 is configured to allow and guide the movement of the respective track assembly 31 and 32 along a sliding direction B orthogonal to the longitudinal axis A of the base frame 20 and orthogonal to the longitudinal median plane of the base frame 20 orthogonal to the upper surface 22 thereof.

[0071] In the example, each movement assembly 33 and 34 comprises one or more support rods 331 and 341 (in the example two in number, e.g. cylindrical).

[0072] The support rods 331 and 341 of each movement assembly 33 and 34 comprise a first end 3310 and 3410 fixed, for example rigidly, to the respective track assembly 31 and 32, preferably to the inner side wall 311 and 321 and/or the outer side wall 312 and 322 thereof (in the example to the outer side wall 312 and 322).

[0073] In the preferred embodiment, the first end 3310 and 3410 of each support tod 331 and 341 is fixed at the top to the upper containment wall of the containment body of the respective track assembly 31 and 32 (and below to the upper branch of the flexible member of the respective track assembly 31 and 32).

[0074] In particular, the first end 3310 and 3410 of each support rod 331 and 341 is fixed to a pair of ears protruding above the upper containment wall of the containment body of the respective track assembly 31 and 32 (and respectively extending above the inner side wall 311 and 321 and/or the outer side wall 312 and 322 of the longitudinal body.

[0075] For example, the first end 3310 and 3410 of each support rod 331 and 341 is fixed to the respective track assembly 31 and 32 for an axial tract of the support rod 331 and 341 substantially equal to the thickness of the containment body of the respective track assembly 31 and 32 (i.e., the distance between the inner side wall 311 and 321 and the outer side wall 312 and 322 thereof).

[0076] Thanks to this solution it is possible to improve the structural stability and the torsional resistance of each track assembly 31 and 32 (having each support rod 331 and 341 a high penetration of the support rod in the thickness of the track assembly).

[0077] The longitudinal axis of the support rods 331 and 341 of each movement assembly 33 and 34 is substantially squared with the inner side wall 311 and 321 to which it is fixed.

[0078] The support rods 331 and 341 of each movement assembly 33 and 34 comprise a second end 3311 and 3411, opposite to the first end 3310 and 3410, which is free.

[0079] The length of the support rods 331 and 341 of each movement assembly 33 and 34 is greater than the width of the base frame 20.

[0080] Each movement assembly 33 and 34 further comprises one or more support metal pipes 332 and 342 (e.g., in a number equal to the number of support rods 331, 341 of each movement assembly 33 and 34, and e.g., cylindrical), wherein each support metal pipe 332, 342 is rigidly fixed to the base frame 20 and configured to house therein at least an axial portion of a respective support rod 331 and 341 (of the respective movement assembly 33 and 34).

[0081] In practice, each support metal pipe 332 and 342 of each movement assembly 33 and 34 comprises a first end 3321,3421 open proximal to and facing the respective track assembly 31 and 32, i.e., the track assembly 31 and 32 supported by the support rod(s) 331 and 341 of the same movement assembly 33 and 34.

[0082] In addition, each support metal pipe 332 and 342 of each movement assembly 33 and 34 comprises an opposite second end 3322,3422, e.g. closed (for example by a closure cap).

[0083] Again, each support metal pipe 332 and 342 of each movement assembly 33 and 34 comprises a longitudinal cavity 3323,3423, e.g. cylindrical, pass-through (full-length) which puts the first end 3321,3421 and the second end 3322,3422 in communication. For example, each support metal pipe 332 and 342 of each movement assembly 33 and 34 has a constant cross-sectional area over its whole longitudinal length.

[0084] Each support metal pipe 332 and 342 of each movement assembly 33 and 34 has a length substantially equal to or higher than the width of the base frame 20.

[0085] For example, each support metal pipe 332 and 342 of each movement assembly 33 and 34 has a length substantially higher than the width of the base frame 20 such that its first end 3321,3421 and the second end 3322,3422 are substantially laterally protruding with respect to the opposite sidewalls 23 of the base frame 20.

[0086] For example, each support metal pipe 332 and 342 is off-centre with respect to the base frame 20.

[0087] In particular, each support metal pipe 332 and 342 has the second end 3322,3422 protruding externally from the respective sidewall 23 of a protruding axial tract of a length greater than the length by which the first end 3321,3421 of the same support metal pipe 332 and 342 protrudes externally from the respective sidewall.

[0088] In greater detail, the protruding axial tract by which the second end 3322,3422 of each support metal pipe 332 and 342 externally protrudes from the respective sidewall 23 has a non-zero length less than or equal to the width of each track assembly 31 and 32. For example, the length of the protruding axial tract is between the width of each track assembly 31 and 32 and half of that width, preferably substantially equal to the width of each track assembly 31 and 32.

[0089] For example, then, the protruding axial tract by which the first end 3321,3421 of each support metal pipe 332 and 342 externally protrudes from the respective sidewall 23 is substantially equal to or slightly less than the minimum distance between each track assembly 31 and 32 with respect to the proximal sidewall 23 when the same track assembly 31 and 32 is in the approached position.

[0090] Each support metal pipe 332 and 342 of each movement assembly 33 and 34 is configured to slidably (substantially to size) house therein a respective support rod 331 and 341 of the same movement assembly 33 and 34 (by fitting the second end 3311 and 3411 of the support rod 331 and 341 from the first end 3321,3421 of the support metal pipe 332 and 342).

[0091] In practice, the support rod(s) 331 and 341 of each movement assembly 33 and 34 are configured to collectively define a prismatic (and/or telescopic) type connection with the respective support metal pipe 332 and 342.

[0092] For example, as shown by way of example in Figures 13B and 14B, a pair of guide bushings B1 and B2 are interposed between each support rod 331 and 341 and the respective support metal pipe 332 and 342.

[0093] The guide bushings B1 and B2 allow to improve the stability of the movement assembly 33 and 34 and to compensate for any irregularities in the shape of the outer surface of each support rod 331 and 34 and of the inner surface of each support metal pipe 332 and 342.

[0094] In detail, at least a first guide bushing B1 (movable) is keyed onto the respective support rod 331 and 341, for example at its second end 3311 and 3411 (always internal to the respective support metal pipe 332 and 342) and a second guide bushing B2 (fixed) is fixed coaxially inside the respective support metal pipe 332 and 342, for example at its first open end 3321,3421 (so as to always be fitted on the respective support rod 331 and 341 with limited radial clearance).

[0095] In practice, the guide bushings B1 and B2 guide the mutual sliding of each support rod 331 and 341 with respect to the respective support metal pipe 332 and 342, approaching and moving away from each other during the relative motion.

[0096] Furthermore, an annular gap is defined between the outer surface of each support rod 331 and 341 and the inner surface of each support metal pipe 332 and 342, which is axially closed between the guide bushings B1 and B2, for example with variable volume. For example, the gap can be filled or partially filled with a lubricating fluid.

[0097] For this purpose, inside each support rod 331 and 341 there is a greasing duct L, which for example opens at the first end 3310 and 3410, so as to emerge (axially) therefrom, for example at a closure disc, by means of a filling fitting.

[0098] The filling fitting can be connected (in a removable way) to a filling device for the lubricating fluid.

[0099] Preferably, the support rod(s) 331 (and the respective support metal pipe(s) 332) of the right movement assembly 33 supporting the right track assembly 31 are offset (and parallel) with respect to the support rod(s) 341 (and the respective support metal pipe(s) 342) of the left movement assembly 34 supporting the left track assembly 32.

[0100] In practice, each support rod 331 and 341 of each movement assembly 33 and 34 is slidably housed at least partially inside the longitudinal cavity 3323 and 3423 of the respective support metal pipe 332 and 342 and is mobile between two axial end-stop positions, of which:

- a first end-stop position, wherein the second end 3311 and 3411 of the support rod 331 and 341 is flush with (or, at best, protrudes axially out of) the longitudinal cavity 3323 and 3423 at the second end side 3322 and 3422 of the support metal pipe 332 and 342 and the respective track assembly 31 and 32 supported by the first end 3310 and 3410 of the same support rod 331 and 341 is in its approached position, and
- a second end-stop position, wherein the second end 3311 and 3411 of the support rod 331 and 341 is axially placed inside the longitudinal cavity 3323 and 3423 (e.g. proximal to the first end 3321 and 3421 of the support metal pipe 332 and 342, i.e. beyond the longitudinal centre line of the support metal pipe 332 and 342) and the respective track assembly 31 and 32 supported by the first end 3310 and 3410 of the same support rod 331 and 341 is in its moved-away position.

[0101] In practice, the second end 3311 and 3411 of each support rod 331 and 341 is configured to protrude axially (like the support metal pipe 332 and 342 supporting it) from the sidewall 23 of the base frame 20 opposite to the one facing the track assembly 31 and 32 supported by the same support rod 331 and 341 (i.e., from the sidewall 23 of the base frame 20 facing the track assembly 31 and 32 opposite to the track assembly 31 and 32 supported by the same support rod 331 and 341).

[0102] In greater detail, the second end 3311 and 3411 of each support rod 331 and 341, when the track assembly 31 and 32 fixed to the first end 3310 and 3410 of the same support rod 331 and 341 is in its approached position, comes flush with the second end 3322 and 3422 of the support metal pipe 332 and 342 and, then protrudes axially from the sidewall 23 of the base frame 20 proximal to the second end 3322 and 3422 of the support metal pipe 332 and 342 by an axial tract having a non-zero length less than or equal to the width of each track assembly 31 and 32.

[0103] For example, the length of the axial tract is between the width of each track assembly 31 and 32 and half of that width, preferably substantially equal to the width of each track assembly 31 and 32.

[0104] The second end 3311 and 3411 of the support rod 331 and 341 of each movement assembly 33 and 34 is configured to be at least partially comprised in the lateral plan size of the opposite track assembly 31 and 32, when both track assemblies 31 and 32 are at least in the respective approached position.

[0105] Equivalently, the second end 3322 and 3422 of the support metal pipe 332 and 342 of each movement assembly 33 and 34 is configured to be at least partially comprised in the lateral plan size of the opposite track assembly 31 and 32 (i.e., of the track assembly 31 and 32 supported by the opposite movement assembly 33 and 34), when said opposite track assembly 31 and 32 is in its approached position.

[0106] Preferably, in the example, the second end 3311 and 3411 of the support rod 331 and 341 of each movement assembly 33 and 34, as well as the second end 3322 and 3422 of the support metal pipe 332 and 342 of each movement assembly 33 and 34, is configured to be fully comprised in the vertical size of the opposite track assembly 31 and 32.

[0107] More specifically, each support rod 331 and 341 of each movement assembly 33 and 34, as well as each support metal pipe 332 and 342 of each movement assembly 33 and 34, is aligned along the sliding direction B to a respective housing seat 315 and 325 of the track assembly 31 and 32 opposite to that supported by the same movement assembly 33 and 34.

[0108] In practice, each support rod 331 of the right movement assembly 33, as well as each support metal pipe 332 of the right movement assembly, is aligned along the sliding direction B to a respective housing seat 325 of the left track assembly 32, and each support rod 341 of the left movement assembly 34, as well as each support metal pipe 342 of the left movement assembly, is aligned along the sliding direction B to a respective housing seat 315 of the right track assembly 31.

[0109] Furthermore, each housing seat 315 and 325 is configured to house (slidably, for example with abundant radial clearance) therein at least the protruding axial tract provided with the second end 3311 and 3411 of the support rod 331 and 341 (aligned therewith), as well as the protruding axial tract provided with the second end 3322 and 3422 of the support metal pipe 332 and 342, supporting the opposite track assembly 31 and 32, when said opposite track assembly 31 and 32 is in its approached position.

[0110] In other words, each housing seat 315 of the right track assembly 31 is configured to house (slidably, for example with abundant radial clearance) therein at least the protruding axial tract provided with the second end 3411 of the support rod 341 supporting (at its first end 3410) the opposite left track assembly 32 and/or the protruding axial tract provided with the second end 3422 of the support metal pipe 342 (aligned therewith), into which the aforesaid support rod 341 supporting the left track assembly 32 is fitted, when the left track assembly 32 is in its approached position, and, likewise, each housing seat 325 of the left track assembly 32 is configured to house (slidably, for example with abundant radial clearance) therein at least the protruding axial tract provided with the second end 3311 of the support rod 331 supporting (at its first end 3410) the right opposite track assembly 31 and/or the protruding axial tract provided with the second end 3322 of the support metal pipe 332 (aligned therewith), into which the aforesaid support rod 331 supporting the right track assembly 31 is fitted, when the right track assembly 31 is in its approached position.

[0111] In practice, such a configuration of each movement assembly 33 and 34 (and of the housing seats 315 and 325) allows the support rods 331 and 341 and, therefore, each of the track assemblies 31 and 32 to move for an axial extra-stroke along the sliding direction B, both approaching and moving away from the base frame 20, for example substantially equal to the aforesaid axial tract length.

[0112] The platform 10 comprises a driving assembly 351 and 352 (independent) for each track assembly 31 and 32, which is configured to drive the sliding along the sliding direction B of the respective track assembly 31 and 32 alternatively between the approached position and the moved-away position (or any position therebetween).

[0113] In particular, the platform 10 comprises a right driving assembly 351 configured to drive the sliding, along the sliding direction B, of the respective right track assembly 31 and a left driving assembly 352 configured to drive the sliding, along the sliding direction B, of the respective left track assembly 32.

[0114] Each driving assembly 351 and 352 comprises (or consists of) a respective (linear) actuator, e.g., fluid-dynamic.

[0115] In the example, each driving assembly 351 and 352 comprises a hydraulic jack, provided with a stem slidably mobile within a cylinder, wherein the stem (i.e. its outer end) can be fixed to the respective track assembly 31 and 32, for example at an inner side wall 311 and 321 thereof, or - preferably - at the top of the upper wall of the longitudinal body (for example through two ears protruding from this upper wall) and below the upper branch of the flexible member (with an axial arrangement - for example of the fixing pin - which can be interposed between the inner side wall 311 and 321 and the outer side wall 312 and 322, as shown in Figures 5A and 7A, or external to the outer side wall 312 and 322, as shown in Figures 13A and 14A), and the cylinder is fixed to the base frame 20, for example so that its free rear end is substantially placed at a sidewall 23 thereof distal from the track assembly to which the stem is fixed (preferably in a position concealed from the outside or axially accessible).

[0116] Each driving assembly 351 and 352 comprises a respective hydraulic circuit, for example contained in a special casing located on the upper surface 22 of the base frame 20, for actuating the hydraulic jack, between an extended configuration, in which the stem is in a position extracted from the cylinder, and a retracted configuration. The variation of the respective hydraulic jack between the extended configuration and the retracted configuration allows the movement of the respective track assembly 31 and 32 with respect to the base frame 20, respectively, between the moved-away and the approached position thereof.

[0117] When the hydraulic jack is in the retracted configuration, the respective track assembly 31 and 32 is in its position approached to the base frame 20. Otherwise, when the hydraulic jack is in the extracted configuration, the respective track assembly 31 and 32 is in its position moved away from the base frame 20. Obviously, each hydraulic jack (and the respective hydraulic circuit) is configured to also bring the respective track assembly 31 and 32 into any intermediate position between the approached position and moved-away position.

[0118] Preferably, when both track assemblies 31 and 32 are both in their approached position, the track assemblies 31 and 32 define a minimum wheel track width (corresponding to the minimum lateral size that the track assemblies 31 and 32 can assume and equal to the minimum lateral size of the whole platform 10), when, on the other hand, both track assemblies 31 and 32 are both in their moved-away position, the track assemblies 31 and 32 define a maximum wheel track width (corresponding to the maximum lateral size that the track assemblies 31 and 32 can assume and equal to the maximum lateral size of the whole platform 10).

[0119] Preferably, the maximum wheel track width is greater by a percentage between 50% and 90%, preferably between 70% and 85%, more preferably equal to 76%, with respect to the minimum wheel track width.

[0120] In particular, the minimum wheel track width is substantially equal to 790 mm and the maximum wheel track width is substantially equal to 1390 mm.

[0121] The maximum stroke allowed by each movement assembly 33 and 34 is substantially equal to 300 mm.

[0122] The platform 10 comprises one or more stabilisers 25, which are configured to stabilise the ground support S of the platform, for example by enlarging the ground support area with respect to the ground support area defined by the track assemblies 31 and 32 (both when they are in their approached position and when they are in their moved-away position).

[0123] For example, the stabilisers 25 are individually movably associated with the base frame 20.

[0124] In particular, each stabiliser 25 is configured to be switchable, alternatively, between a working position, in which the stabiliser 25 is laying on the ground S (for example so as to be added to or replace the ground support S defined by one or both of the track assemblies 31 and 32), moving to a lower level of the lower surface 21 of the base frame 20, and a rest position, in which it is lifted from the ground, for example it is arranged at a higher height than the lower surface 21 of the base frame 20, preferably but not limited to a higher height of the upper surface 22.

[0125] Each stabiliser 25, at least in the working position or only in this working position, protrudes laterally and/or longitudinally beyond the lateral and/or longitudinal (plan) size of the base frame 20 and, preferably, also of the track assemblies 31,32 (even when they are in their enlarged position).

[0126] In the example, each stabiliser 25 comprises a ground support foot arranged at the free end of a support arm, which has an opposite end constrained to the base frame 20, for example with a constraint such that the support arm has at least one degree of freedom. Preferably, (the constrained end of) the support arm is rotatably coupled to the base frame 20, for example by means of a hinge.

[0127] In the example, the platform 10 comprises four stabilisers 25, of which two front stabilisers (one right and one left) and two rear stabilisers (one right and one left).

[0128] In the example, each stabiliser 25 in its working position protrudes laterally and longitudinally (anteriorly or posteriorly, depending on whether it is a front or rear stabiliser) from the base frame 20 (and from the proximal track assembly 31, 32).

[0129] In the rest position, however, each stabiliser 25 is contained within the lateral and longitudinal size of the base frame 20.

[0130] Each stabiliser 25 further comprises, an actuator 26, which is configured to alternatively move the stabiliser 25 between any working position and the rest position, for example by stopping the stabiliser 25 in one of them stably.

[0131] Preferably, each actuator 26 is defined by a jack (hydraulic or pneumatic) comprising an outer body hinged to one between the base frame 20 and the stabiliser 25 (e.g., to the base frame 20) and an extractable inner stem hinged to the other between the stabiliser 25 and the base frame 20 (e.g., the stabiliser 25).

[0132] It is not excluded, however, that the shape and the arrangement of the stabilisers 25 (and of the respective actuators 26) may be different from that shown and described, or may be of any known type of stabilisers adopted in this type of platform 10.

[0133] The platform 10 further comprises a powered fifth wheel 40 supported on top of the base frame 20.

[0134] The fifth wheel 40, for example, comprises a first lower ring (rigidly fixed to the upper surface 22 of the base frame 20), which is rotatably coupled to a second upper ring with respect to a (single) rotation axis.

[0135] The fifth wheel 40 further comprises an electric motor provided with an encoder, which is configured to rotatably drive the second ring with respect to the first ring (and is supported by the first ring) about the rotation axis, for example by an angle equal to (at least) 360° (or higher).

[0136] The platform 10 further comprises an elevating arm 60, that is, configured to be lifted and lowered with respect to the ground S.

[0137] For example, the elevating arm 60 is of the extendable type, the term "extendable" being understood in a general sense meaning that it is capable of extending its length, that is it can be actuated alternatively between a contracted configuration and an extended configuration, for example in a telescopic manner or in a jointed manner or by means of a combination of telescopic and jointed connections.

[0138] The elevating arm 60 is carried by the fifth wheel 40, i.e., by the second ring thereof, by interposition of a support base, which is rigidly fixed (e.g., by bolts) at the top of the second ring thereof and, for example, is provided with counterweights.

[0139] The elevating arm 60 comprises, in the example, a first arm section 61, a first end of which (proximal to the fifth wheel 40) is jointed to the support base (and therefore to the fifth wheel 40) so as to be able to oscillate with respect thereto about a (single) articulation axis, which is (always) orthogonal to the rotation axis of the fifth wheel 40.

[0140] In practice, the first end of the first section 61 (i.e., the elevating arm 60) is hinged to the support base by means of a hinge pin defining said articulation axis.

[0141] The first section 61 of the elevating arm 60 is rotatable about its articulation axis between two distinct end-stop positions, of which a first lower rest position (see Figure 1), wherein the first section 61 lies in a plane substantially orthogonal to the rotation axis of the fifth wheel 40, a second upper operating position (see Figure 8), wherein the first section 61 is arranged with longitudinal development substantially parallel to the rotation axis of the fifth wheel 40.

[0142] The first section 61 of the elevating arm 60 is, in the example, telescopic (with two or more tracts).

[0143] In particular, the first section 61 comprises a first (outer) tract, which has a first end (defining the first end of the same first section) hinged, as described above, to the support base and at least a second (inner) tract, which is slidably coupled to the first tract and comprises a first end inserted into the first tract and a second free end.

[0144] The second tract is slidable within the first tract between two end-stop positions, of which a first retracted position, wherein the second end of the second tract is proximal to a second (free) end of the first tract, and a second extracted position, wherein the second end of the second tract is distal from the second (free) end of the first tract.

[0145] In the example, the first section 61 of the elevating arm 60 further comprises a third (inner) tract, which is in turn slidably coupled to the second tract and comprises a first end inserted into the second tract and a second free end.

[0146] The third tract is also slidable within the second tract between two end-stop positions, of which a first retracted position, wherein the second end of the third tract is proximal to the second (free) end of the second tract, and a second extracted position, wherein the second end of the third tract is distal from the second (free) end of the second tract. The second end of the last tract of the series of tracts defining the first section 61 of the elevating arm 60, in the example of the third tract, actually defines the second end of the same first section 61.

[0147] The second tract (as well as the third tract), i.e., each tract of the first section 61 (except for the first tract) is thus alternatively mobile between the respective retracted position and the respective extracted position.

[0148] Thus, the first section 61 is, overall, operable between a retracted configuration (of maximum contraction), which is defined when all of the tracts of which the first section 61 is composed are in their retracted position, and an extended configuration (of maximum extension), which is defined when all of the tracts of which the first section 61 is composed are in their extended position.

[0149] The elevating arm 60, for example, comprises a second arm section 62, which preferably comprises a first end constrained to the second (free) end of the first arm section 61 and an opposite free end.

[0150] For example, the second section 62, also referred to as jib, is jointed to the first section 61 by means of at least one connecting axis parallel to the articulation axis that constrains the first section 61 to the fifth wheel 40 (i.e., to the support base).

[0151] In the example, the second section 62 is defined by an articulated quadrilateral, wherein all connecting axes are parallel to each other and parallel to the articulation axis.

[0152] The second section 62 is mobile about one or more connecting axes between a first working position, in which it is substantially squared to the first section 61 (e.g., parallel thereto), and a second working position, in which it is substantially aligned with and axially extends the first section 61.

[0153] The platform 10 comprises, then, a first driving assembly 65 configured to rotatably drive the elevating arm 60, i.e. (the first tract of) the first section 61, about its articulation axis between the two distinct end-stop positions.

[0154] The first driving assembly 65 comprises a first hydraulic jack, provided with a stem slidably mobile within a cylinder, wherein the stem in the example is hinged to the support base about a hinge axis parallel and eccentric to the articulation axis and the cylinder is hinged to the first section 61 (i.e., the first tract thereof) about a hinge axis parallel and eccentric to the articulation axis, for example at two anchoring ears located near a zone that is intermediate between the first end and the second end of the first tract.

[0155] The first driving assembly 65 comprises a respective hydraulic circuit, for example contained in the casing located on the upper surface 22 of the base frame 20, for actuating the first hydraulic jack, between an extended configuration, in which the stem is in a position extracted from the cylinder, and a retracted configuration. The variation of the first hydraulic jack between the extended configuration and the retracted configuration allows the rotation of the elevating arm 60 as a whole with respect to the fifth wheel 40 (i.e., with respect to the support base), respectively between the second upper position and the first lower position thereof.

[0156] When the first hydraulic jack is in the retracted configuration, the elevating arm 60 as a whole (i.e., the first section 61) is in its first lower position. Otherwise, when the first hydraulic jack is in the extracted configuration, the elevating arm 60 as a whole is in its second upper position. Obviously, the first hydraulic jack (and the respective hydraulic circuit) is configured to bring (and support) the elevating arm 60 also into any position that is intermediate between the first lower position and the second upper position.

[0157] The platform 10 comprises, then, a second driving assembly 66 configured to drive the extension (and contraction) of the elevating arm 60.

[0158] For example, the second driving assembly 66 comprises a first linear actuator (or a plurality of first linear actuators), which is configured to drive the extension and contraction of the first section 61 of the elevating arm 60.

[0159] The first linear actuator is, preferably, contained within (the box-like structure) of the first section 61.

[0160] The first linear actuator comprises a respective hydraulic circuit, for example contained in the casing located on the upper surface 22 of the base frame 20, for actuating the first linear actuator between an extended configuration and a retracted configuration. The variation of the first linear actuator between the extended configuration and the retracted configuration allows the first section 61 to be switched between its extended configuration (of maximum extension) and its retracted configuration (of maximum contraction).

[0161] Obviously, the first linear actuator (and the respective hydraulic circuit) is configured to bring the first section 61 of the elevating arm 60 into any configuration that is intermediate between the extended configuration and the retracted configuration.

[0162] The platform 10 further comprises a third driving assembly 67, which is configured to rotatably drive the second section 62 of the elevating arm 60 with respect to the first section 61.

[0163] The third driving assembly 67 comprises, for example, a second linear actuator provided with a stem slidably mobile within a cylinder, wherein the stem in the example is hinged to the second free end (of the third tract) of the first section 61 about a hinge axis parallel and eccentric to the connecting axis and the cylinder is hinged to the second section 62 about a hinge axis parallel and eccentric to the connecting axis, for example, at two anchoring ears located near a zone that is intermediate between the first end and the second end of the second section 62.

[0164] The third driving assembly 67 comprises a hydraulic circuit, for example contained in the casing located on the upper surface 22 of the base frame 20, for actuating the second linear actuator between an extended configuration, in which the stem is in a position extracted from the cylinder, and a retracted configuration. The variation of the second linear actuator between the extended configuration and the retracted configuration allows the rotation of the second section 62 with respect to the first section 61 of the elevating arm 60, respectively, between the second working position and the first working position thereof.

[0165] When the second linear actuator is in the retracted configuration, the second section 62 is in its first working position. Otherwise, when the second linear actuator is in the extracted configuration, the second section 62 is in its second working position. Obviously, the second linear actuator (and the respective hydraulic circuit) is configured to bring (and support) the second section 62 into any position that is intermediate between the first working position and the second working position.

[0166] The second end of the second section 62, i.e., the second free end of the elevating arm 60 as a whole, comprises a coupling or connection attachment (for example, provided with a joint with an axis parallel to the rotation axis of the fifth wheel 40), which is intended to be connected, in a releasable manner, to the operating assembly 70.

[0167] In the example, the operating assembly 70 comprises a nacelle 71, intended to support and transport one or more persons.

[0168] Again, the operating assembly 70 may comprise a winch, e.g., motorised, or other load-lifting system, such as a hook, a vice, a clamp or similar.

[0169] In particular, the platform 10 can be variously configured and modified by providing for the possibility of selectively hooking the nacelle 71 and the winch to the second end of the elevating arm 60.

[0170] The nacelle 71 is hinged to a free end of the second section 62 about a hinge axis parallel to the articulation axis of the first section 61.

[0171] In addition, the platform 10 comprises a fourth driving assembly 68, which is configured to rotatably drive the nacelle with respect to the second section 62 of the elevating arm 60.

[0172] The platform 10 further comprises an electronic control system 80.

[0173] In the embodiment considered, the control system 80 comprises a controller module 81, a sensor assembly 82 and, optionally, a user interface 83.

[0174] In particular, the controller module 81 comprises an electronic control unit 810 (for example, comprising at least one of a microcontroller, a microprocessor, an FPGA, an ASIC, etc.) and, optionally, a storage unit 811 (comprising, non-volatile memory elements and, preferably, volatile memory elements) interconnected with each other and adapted to process and store, respectively, information - for example, in binary format. The sensor assembly 82 comprises, for example, a first orientation sensor, e.g., mounted on the fifth wheel or on the base frame 20, configured to detect an orientation of the base frame 20 with respect to a zero position at which the base frame 20 is laying on the ground (i.e., the ground support plane defined by the track assembly 31 and 32) is substantially horizontal.

[0175] Orientation, for example, means an absolute orientation with respect to an absolute reference system defined by a horizontal plane (x,y) and a vertical axis (z).

[0176] The sensor assembly 82 further comprises a first distance sensor configured to detect a parameter indicative of the distance between the right track assembly 31 and the base frame 20 along the sliding direction B, which is for example mounted on the base frame 20 or on the right track assembly 31.

[0177] The sensor assembly 82 further comprises a second distance sensor configured to detect a parameter indicative of the distance between the left track assembly 32 and the base frame 20 along the sliding direction B, which is for example mounted on the base frame 20 or on the left track assembly 32.

[0178] The first distance sensor and the second distance sensor are, for example, proximity sensors or other types of sensors, e.g., mounted on the respective hydraulic jacks defining the respective driving assembly 351, 352.

[0179] The sensor assembly 82 comprises, for example, also a first angle sensor, which is for example mounted on the fifth wheel 40 and is configured to detect, with respect to a zero angular position, a relative angular position between the first ring and the second ring of the fifth wheel 40.

[0180] For example, the zero angular position is defined at a position whereby the elevating arm 60 is superimposed in plan on the base frame 20 and substantially centred thereon, i.e., lying on a longitudinal median plane of the base frame 20.

[0181] For example, the first angle sensor is defined by the encoder of the electric motor of the fifth wheel 40.

[0182] Again, the sensor assembly 82 may further comprise a second angle sensor, for example mounted on one between the support base and the first section 61 of the elevating arm 60, which is configured to detect an angular position (of the first section 61) of the elevating arm 60 with respect to the fifth wheel 40 (i.e., with respect to the support frame) about the articulation axis from the first lower position (assumed as zero position).

[0183] The sensor assembly 82 further comprises an extension sensor, for example mounted on the first section 61 of the elevating arm 60, which is configured to detect an extension (of the first section 61) of the elevating arm 60 with respect to the retracted configuration thereof (assumed as zero position).

[0184] Again, the sensor assembly 82 may comprise a third angle sensor, for example mounted on one between the first section 61 and the second section 62 of the elevating arm 60, which is configured to detect an angular position of the second section 62 with respect to the first section 61 about the connecting axis with respect to the first working position (assumed as zero position).

[0185] In addition, the sensor assembly 82 may comprise a fourth angle sensor, for example mounted on the coupling or connection attachment, which is configured to detect an angular position of the operating assembly 70 with respect to the second section 62 about the axis of the joint defined by the coupling or connection attachment with respect to an alignment position (assumed as zero position).

[0186] Finally, the sensor assembly 82 may comprise a load sensor, such as a load cell, mounted on at least one between the operating assembly 70 and the coupling or connection attachment (or the second section 62), which is configured to detect a load weighing on the operating assembly 70 (e.g., supported by it or intended to be lifted by it).

[0187] The sensors of the sensor assembly 82 globally are individually operatively connected to the controller module 81 and, preferably, to the electronic control unit 810 thereof.

[0188] Finally, if provided, the user interface 83 may comprise an input module for receiving instructions from an operator and an output module for providing the operator with information. The user interface 83 may be integrated into the platform 10, for example at the casing or the nacelle 71, and/or be separate or separable therefrom. Accordingly, the user interface 83 may be wired to the controller module 81 and/or comprise a transceiver element for communicating with a corresponding transceiver element (not shown) comprised in the controller module 81.

[0189] The control system 80, i.e., the electronic control unit 810, is further operatively connected to each motor 310 and 320 of the respective track assembly 31 and 32 to drive the movement thereof on the ground S.

[0190] "Movement" or "moving" of the platform 10 on the ground S is understood herein as a translation displacement of the platform 10 (i.e. of its base frame 20) along a trajectory controlled by the user, for example by means of the user interface 83 and the controller module 81, for example by means of the command of the actuation (by the controller module 81) of the motors 310 and 320 (individually or simultaneously) of the respective track assemblies 31 and 32.

[0191] The control system 80, i.e., the electronic control unit 810, is further operatively individually connected to the first driving assembly 65, to the second driving assembly 66, to the third driving assembly 67, and to the fourth driving assembly 68.

[0192] The platform 10 is operable in a controlled manner, by means of the control system 80, as will be better described below.

[0193] For example, the platform 10 is operable in a controlled manner to perform certain processings (in addition to translation under transport conditions) even when the stabilisers 25 are in the rest position.

[0194] In particular, with the stabilisers 25 in the rest position, the platform 10 is operable according to the following operating cycle.

[0195] The control system 80 is then configured to operate the elevating arm 60 by controlling its stabilisation, as described in more detail below.

[0196] In particular, the controller module 81 of the control system 80 is configured to implement a method of automatic control and stabilisation of the elevating arm 60, in particular during the movement or during a stationary condition of the platform 10 on a surface, or ground S, which is irregular or characterized by a slope, i.e., inclined with respect to the absolute horizontal plane O.

[0197] The control and stabilisation method provides, in particular, that the controller module 81 is configured to measure (block S1 of the flow diagram in Figure 11) a value of the orientation of the base frame 20 (through the first orientation sensor).

[0198] The controller module 81 can be configured to acquire the orientation measurements through the sensor assembly 82 continuously, periodically or asynchronously.

[0199] In the case where the track assemblies 31 and 32 are individually mobile, as described above, between a respective approached position and a respective moved-away position, the control and stabilisation method may provide, in particular, that the controller module 81 is configured to measure or determine (block S2 of the flow diagram of Figure 11) a first value of a distance between the right track assembly 31 from the base frame 20 and to measure or determine (block S3 of the flow diagram of Figure 11) a second value of a distance between the left track assembly 32 from the base frame 20. Advantageously, the control system 80 is configured to control an articulation arc about the articulation axis of the elevating arm 60, i.e., of the first section 61, for example by controlling the actuation of the first driving assembly 65 based on the measured orientation value (and/or the first distance value and the second distance value measured or determined).

[0200] In particular, the control system 80 is configured to determine (block S4) a maximum value of the articulation arc of the elevating arm 60, i.e., of the first section 61, as a function of the measured orientation value (and/or the first distance value and the second distance value measured or determined).

[0201] The maximum value of the articulation arc, for example, is a variable value as a function of the measured orientation value (and/or the first distance value and the second distance value measured or determined) and may be less than the maximum articulation arc value allowed by the conformation of the elevating arm 60.

[0202] The control system 80, therefore, for the given measured orientation value (and/or the first distance value and the second distance value measured or determined), allows the actuation of the first driving assembly 65 (e.g. by the operator) for articulation arc values less than or equal to the maximum value of the articulation arc of the elevating arm 60 determined and, thereby inhibits the actuation of the first driving assembly 65 to actuate the elevating arm 60, i.e. the first section 61, for extension strokes greater than the maximum value of the articulation arc of the elevating arm 60 determined.

[0203] In practice, the control system 80 allows the inclination (lifting) of the elevating arm 60, i.e., of the first section 61, only in a stability area determined on the basis of the (absolute) orientation of the base frame 20, inhibiting the inclination of the elevating arm 60 beyond articulation arc values that would be critical for the gravitational stability of the platform 10.

[0204] This maximum value of the articulation arc is, moreover, determined as a function of a load acting on the operating assembly 70.

[0205] In particular, the control system 80 is configured to measure (block S5) a value of a load acting on the operating assembly 70.

[0206] For example, the maximum value of the articulation arc of the elevating arm 60, i.e. of the first section 61, is determined as the output of one (or more) map, for example the same aforesaid map, pre-calibrated and stored in the storage unit 811 which receives as input the measured orientation value (and/or the first distance value and the second distance value measured or determined and/or the load value acting on the operating assembly 70).

[0207] This pre-calibrated map can be pre-determined during experimental activities designed as a function of structural calculations in various configurations of inclination of the base frame and, for example, of extension of the wheel track due to the distance of the track assemblies 31 and 32 from base frame 20 and of the load acting on the operating assembly 70.

[0208] Independently or in coordination with the above, the control system 80 is configured to control an articulation arc about the articulation axis of the second section 62, for example by controlling the actuation of the third driving assembly 67, based on the measured orientation value (and/or the first distance value and the second distance value measured or determined).

[0209] In particular, the control system 80 is configured to determine (block S6) a maximum value of the articulation arc of the second section 62 as a function of the measured orientation value (and/or the first distance value and the second distance value measured or determined).

[0210] The maximum value of the articulation arc, for example, is a variable value as a function of the measured orientation value (and/or the first distance value and the second distance value measured or determined) and may be less than the maximum articulation arc value allowed by the conformation of the second section 62.

[0211] The control system 80, therefore, for the given measured orientation value (and/or the first distance value and the second distance value measured or determined), allows the actuation of the third driving assembly 67 (e.g. by the operator) for articulation arc values less than or equal to the maximum value of the articulation arc of the second section 62 determined and, therefore, inhibits the actuation of the second linear actuator to actuate the second section 62 for angular strokes greater than the maximum value of the articulation arc of the second section 62 determined.

[0212] In practice, the control system 80 allows the inclination (lifting) of the second section 62 only in a stability area determined on the basis of the (absolute) orientation of the base frame 20, inhibiting the inclination of the second section 62 beyond articulation arc values that would be critical for the gravitational stability of the platform 10.

[0213] The aforesaid maximum value of the articulation arc of the second section 62 is, moreover, determined as a function of a load acting on the operating assembly 70.

[0214] In particular, the control system 80 is configured to measure (as described above) a value of a load acting on the operating assembly 70.

[0215] For example, the maximum value of the articulation arc of the second section 62 is determined as the output of one (or more) map, for example the same aforesaid map, pre-calibrated and stored in the storage unit 811 which receives as input the measured orientation value (and/or the first distance value and the second distance value measured or determined and/or the load value acting on the operating assembly 70).

[0216] This pre-calibrated map can be pre-determined during experimental activities designed as a function of structural calculations in various configurations of inclination of the base frame and, for example, of extension of the wheel track due to the distance of the track assemblies 31 and 32 from base frame 20 and of the load acting on the operating assembly 70.

[0217] Generally, the control system 80 is configured to keep the first section 61 in a retracted configuration (when the stabilisers 25 are in the rest position).

[0218] It is not excluded, however, that the control system 80 may be configured to control an extension stroke of the elevating arm 60, for example by controlling the actuation of the second driving assembly 66 based on the measured orientation value (and/or the first distance value and the second distance value measured or determined).

[0219] In such a case, the control system 80 is configured to determine a maximum value of the extension stroke of the elevating arm 60 as a function of the measured orientation value (and/or the first distance value and the second distance value measured or determined).

[0220] The maximum value of the extension stroke, for example, is a variable value as a function of the measured orientation value (and/or the first distance value and the second distance value measured or determined) and may be less than the maximum extension stroke value allowed by the conformation of the elevating arm 60.

[0221] The control system 80, therefore, for the given measured orientation value (and/or the first distance value and the second distance value measured or determined), allows the actuation of the second driving assembly 66 (e.g. by the operator) for extension stroke values less than or equal to the maximum value of the extension stroke of the elevating arm 60 determined and, thereby inhibits the actuation of the second driving assembly 66 to actuate the elevating arm 60 for extension strokes greater than the maximum extension stroke value of the elevating arm 60 determined.

[0222] In practice, the control system 80 allows the extension of the elevating arm 60 only within a stability area determined on the basis of the (absolute) orientation of the base frame 20, inhibiting the extension of the elevating arm 60 beyond extension values that would be critical to the gravitational stability of the platform 10.

[0223] The aforesaid maximum value of the extension stroke can further be determined as a function of a load acting on the operating assembly 70.

[0224] In particular, the control system 80 is configured to measure (as described above) a value of a load acting on the operating assembly 70.

[0225] For example, the maximum value of the extension stroke of the elevating arm 60 is determined as the output of one (or more) pre-calibrated map stored in the storage unit 811 which receives as input the measured orientation value (and/or the first distance value and the second distance value measured or determined and/or the load value acting on the operating assembly 70).

[0226] This pre-calibrated map can be pre-determined during experimental activities designed as a function of structural calculations in various configurations of inclination of the base frame 20 and, for example, of extension of the wheel track due to the distance of the track assemblies 31 and 32 from the base frame 20 and of the load acting on the operating assembly 70.

[0227] For example, a map may be defined for each (discrete) point of the variables which are then interpolated by the control system 80 to find the output corresponding to the measured input or, alternatively, a map may be provided for each possible input.

[0228] The control system 80 is, moreover, configured to keep the nacelle 71 with walkable plane always horizontal by acting on the fourth driving assembly 68 and by an angle sensor of the sensor assembly 82 placed on the nacelle 71.

[0229] In addition, the control system 80 is, moreover, configured to keep the nacelle 71 with walkable plane always horizontal even when the platform 10 is translating on the track assemblies 31 and 32, for example in a slope variation zone of the ground S.

[0230] In such a case, the control system 80 acts on the first driving assembly 65 so as to keep fixed (during the transient slope change of the ground S) the absolute inclination of the first section 61 of the elevating arm 60, for example by keeping the nacelle 71 with walkable plane always horizontal or at most by correcting the position of the nacelle 71 (through the fourth driving assembly 68) so as to bring its walkable plane horizontal.

[0231] In practice, it has been observed that the stabilised platform 10 (i.e. provided with stabilisers 25), thanks to the conformation of the movement assemblies 33 and 34 described above (and of the housing seats 315 and 325), can be allowed to be used (safely) in different operating configurations that allow the elevating arm 60 to be lifted (over 2 or 3 metres in height) and/or to be driven in translation on the track assemblies 31 and 32 even with the stabilisers 25 in the rest position.

[0232] With the same control logic, if the stabilisers 25 are then brought into the working position, the platform 10 will be allowed a greater working area (in a fixed position) in stability.

[0233] The invention thus conceived is susceptible to several modifications and variations, all falling within the scope of the inventive concept.

[0234] Moreover, all the details can be replaced by other technically equivalent elements.

[0235] In practice, the materials used, as well as the contingent shapes and sizes, can be whatever according to the requirements without for this reason departing from the scope of protection of the following claims.

Claims

1. A mobile elevating work platform (10) which comprises:

- a self-propelled base frame (20);
- an elevating arm (60), one first end of which is jointed to the base frame (20) and one second opposite free end of which is adapted to be fixed to an operating assembly (70);
- a plurality of stabilisers (25) associated to the base frame (20) each of which is alternatively mobile between a working position, wherein it is laid on the ground, and a rest position, wherein it is lifted from the ground;
- a pair of longitudinal track assemblies (31,32) opposite with respect to the base frame (20) to lay it on the ground,
- a pair of movement assemblies (33,34), wherein each movement assembly is configured to move a respective track assembly (31,32) relative to the base frame (20), between a position approached to the base frame (20) and a position moved away from it, wherein each movement assembly (33,34) comprises at least a support rod (331,341) supporting at a first end (3310,3410) the respective track assembly (31,32),

characterized in that a second end (3311,3411) of the support rod (331,341) opposite to the first end (3310,3410) of each movement assembly (33,34) is configured to be at least partially comprised in the lateral plan size of the opposite track assembly (31,32) when both track assemblies (31,32) are in the respective approached position.

2. The mobile elevating work platform (10) according to claim 1, wherein each track assembly (31,32) comprises a housing seat (315,325) configured to house therein at least an end tract provided with the second end (3311,3411) of the support rod (331,341) supporting the opposite track assembly (31,32).

3. The mobile elevating work platform (10) according to claim 1, wherein each movement assembly (33,34) comprises at least a support metal pipe (332,342) rigidly fixed to the base frame (20) and provided with:

- a first end (3321,3421) that is proximal and facing the respective track assembly (31,32);
- an opposite open second end (3322,3422); and
- a longitudinal pass-through cavity (3323,3423) which puts the first end (3321,3421) and the second end (3322,3422) in communication;

the support rod (331,341) of each movement assembly (33,34) is slidably housed at least partially inside the longitudinal cavity (3323,3423) of the respective support metal pipe (332,342) and is mobile between two axial end-stop positions, of which

a first end-stop position, wherein the second end (3311,3411) of the support rod (331,341) is flush or protrudes axially out of the longitudinal cavity (3323,3423) at the second end side thereof and the respective track assembly (31,32) supported by the first end (3310,3410) of the support rod (331,341) is in its approached position, and
a second end-stop position, wherein the second end (3311,3411) of the support rod (331,341) is axially placed inside the longitudinal cavity (3323,3423) and the respective track assembly (31,32) supported by the first end (3310,3410) of the support rod (331,341) is in its moved-away position.

4. The mobile elevating work platform (10) according to claim 1, wherein each movement assembly (33,34) comprises an actuator (351,352) configured to move the respective track assembly (31,32) alternatively between the approached position and the moved-away position.

5. The mobile elevating work platform (10) according to claim 1, which comprises a powered fifth wheel

(40) supported at the top to the base frame (20) and rotatable relative to a rotation axis, the first end of the elevating arm (60) being jointed to the fifth wheel (40) relative to an articulation axis orthogonal to the rotation axis of the fifth wheel (40).

6. The mobile elevating work platform (10) according to the preceding claim, which comprises a first driving assembly (65) configured to drive the tilting of the elevating arm (60) about its articulation axis and/or a second driving assembly (66) configured to drive the extension of the elevating arm (60).

7. The mobile elevating work platform (10) according to claim 1, wherein when both track assemblies (31,32) are in the moved-away position, it has a maximum wheel track width increased of a percentage between 50% and 90%, preferably between 70% and 85%, more preferably of 76%, with respect to a minimum wheel track width as defined when both track assemblies (31,32) are in the approached position.

8. The mobile elevating work platform (10) according to claim 1, wherein each track assembly (31,32) has a length higher than 2 m.

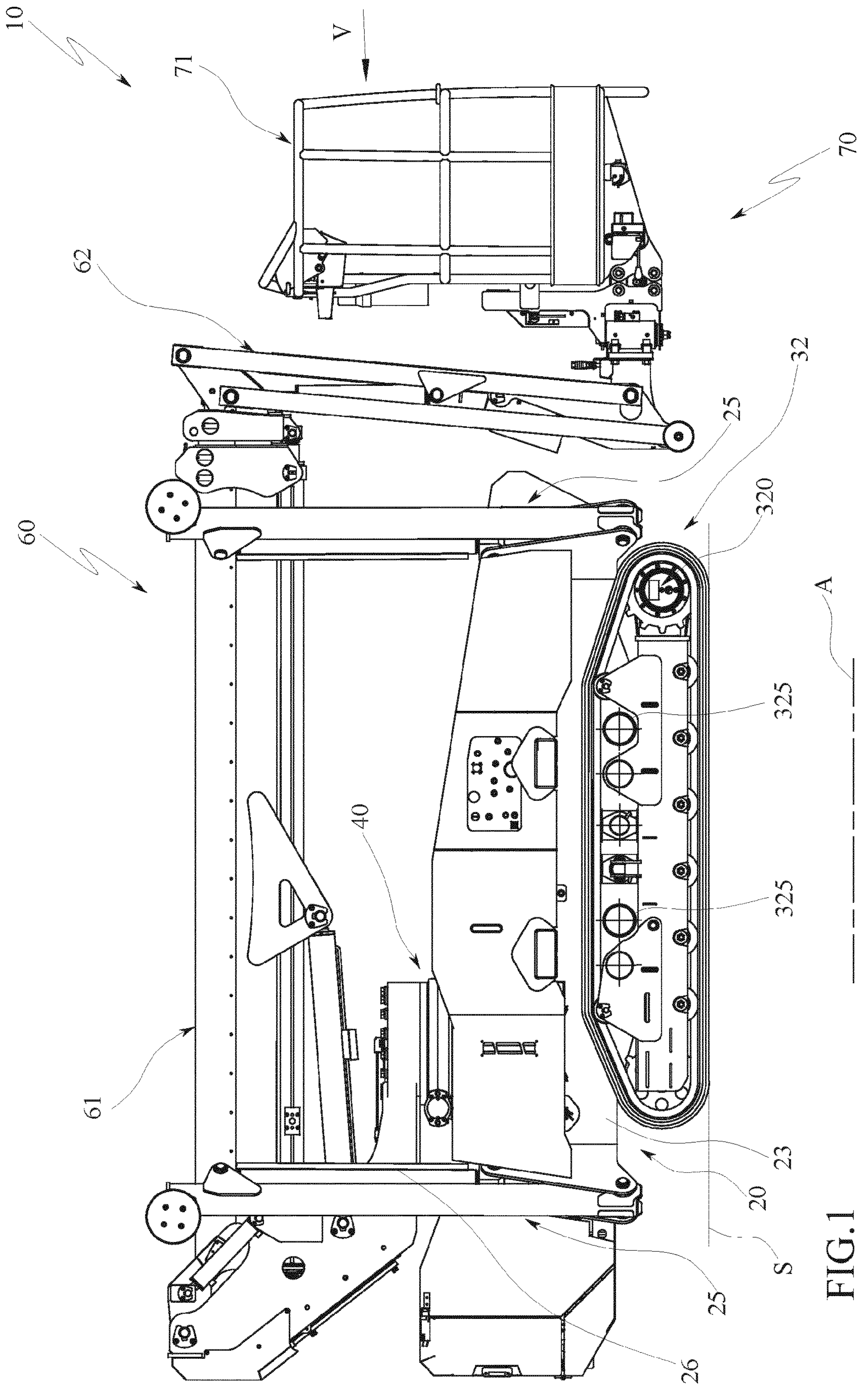


FIG.1

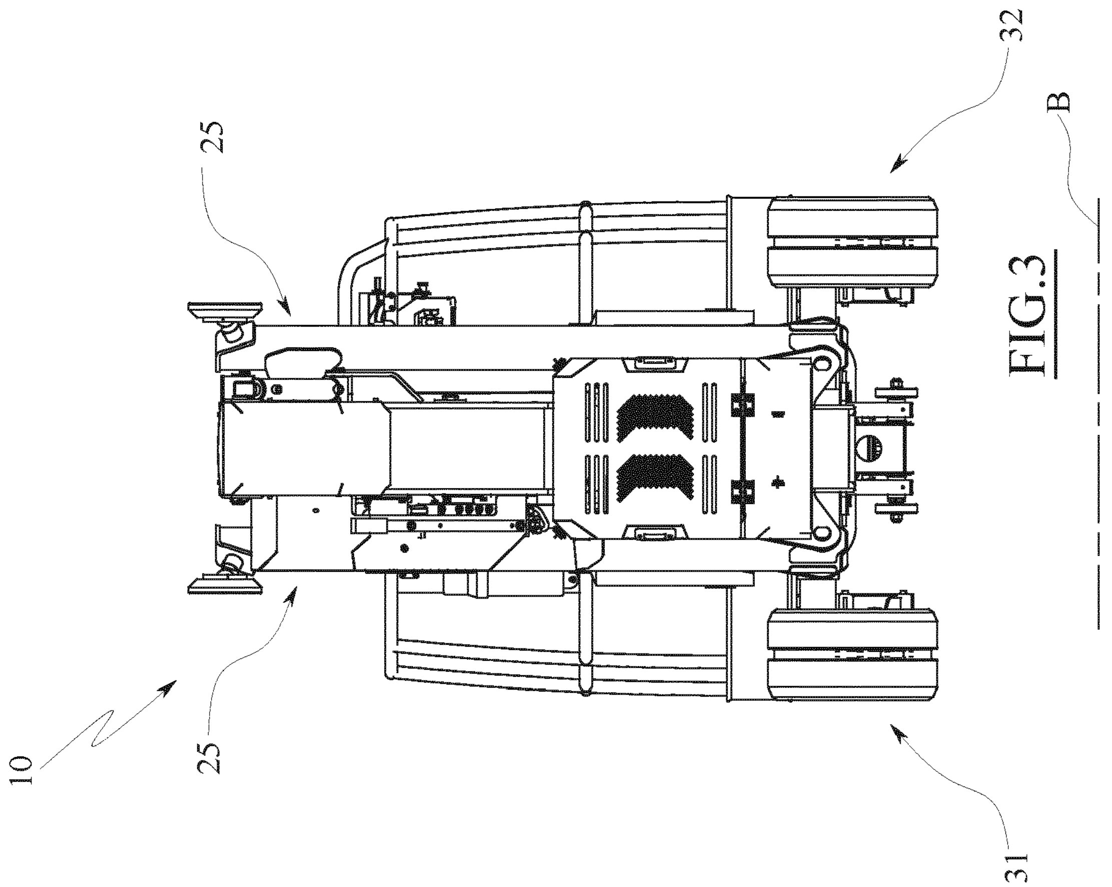


FIG.3

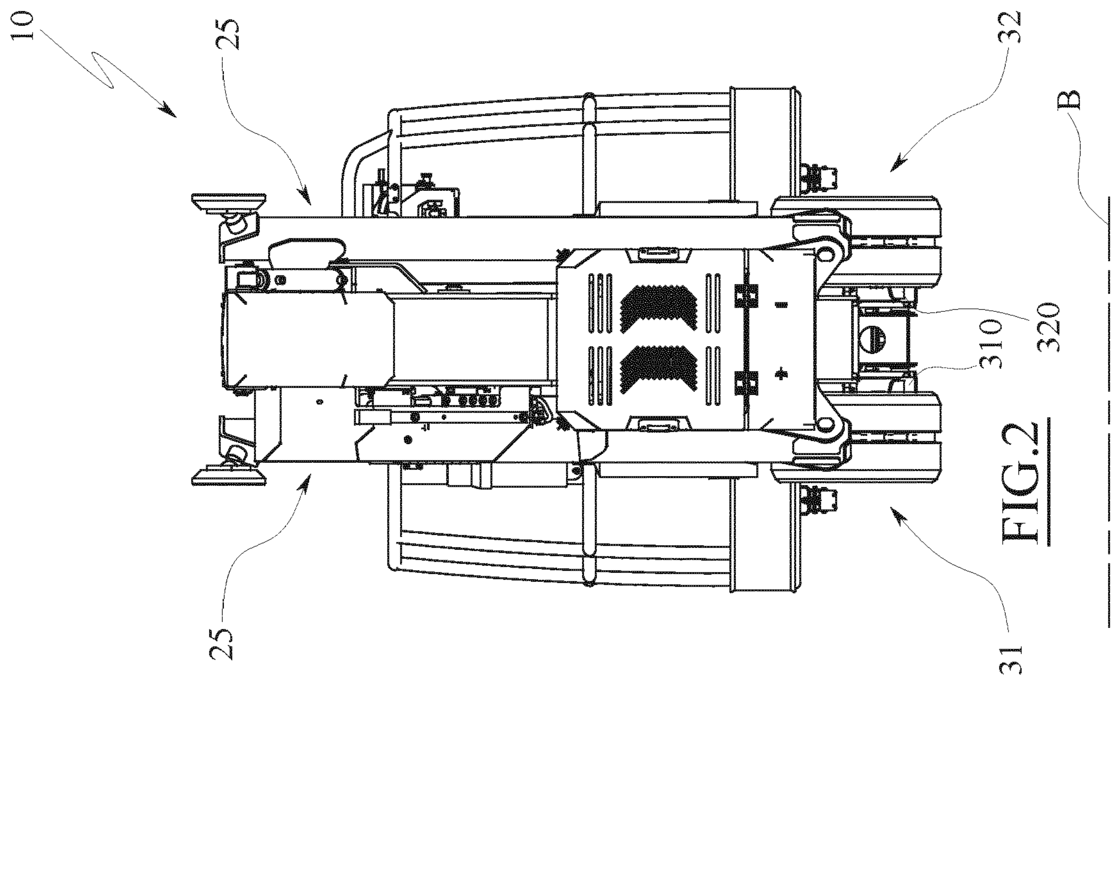


FIG.2

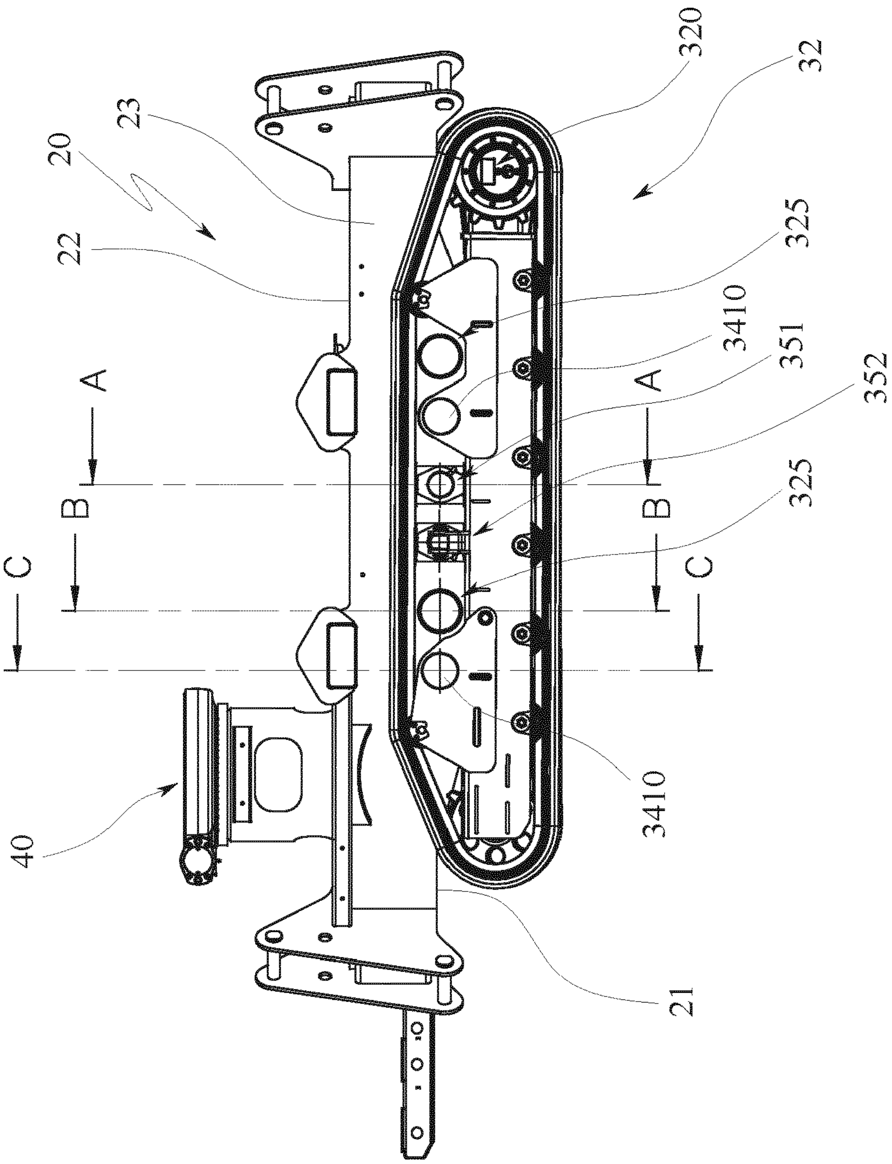


FIG.4

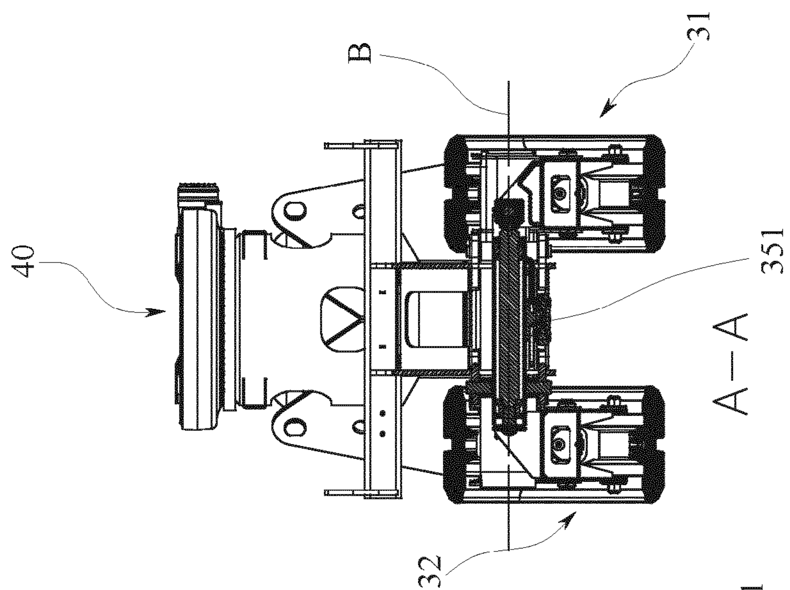


FIG.5A

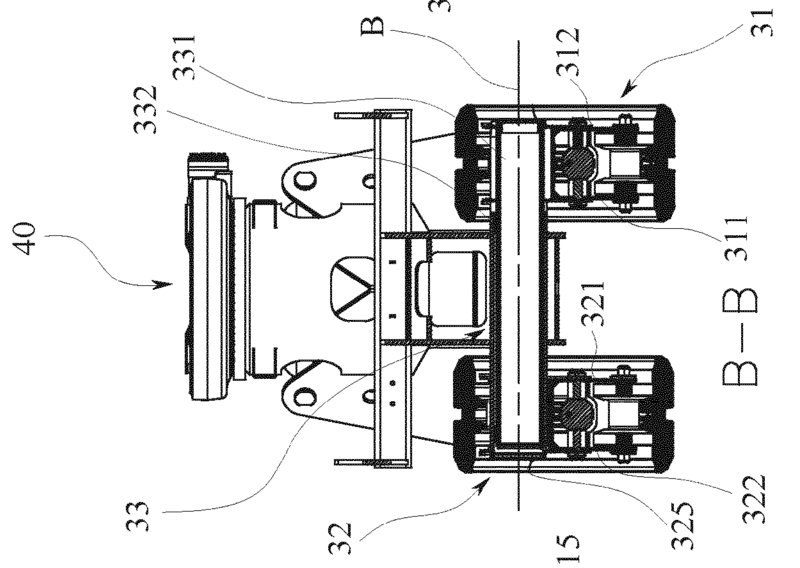


FIG.5B

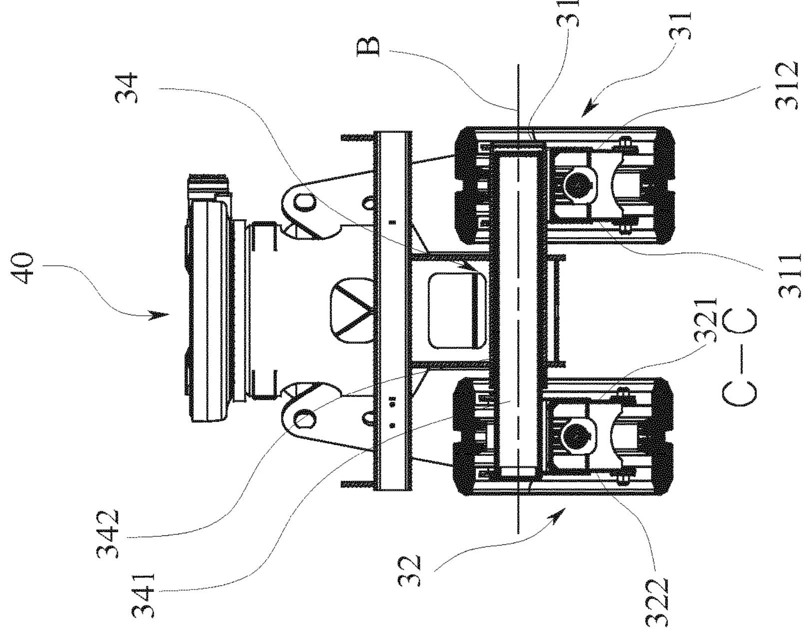


FIG.5C

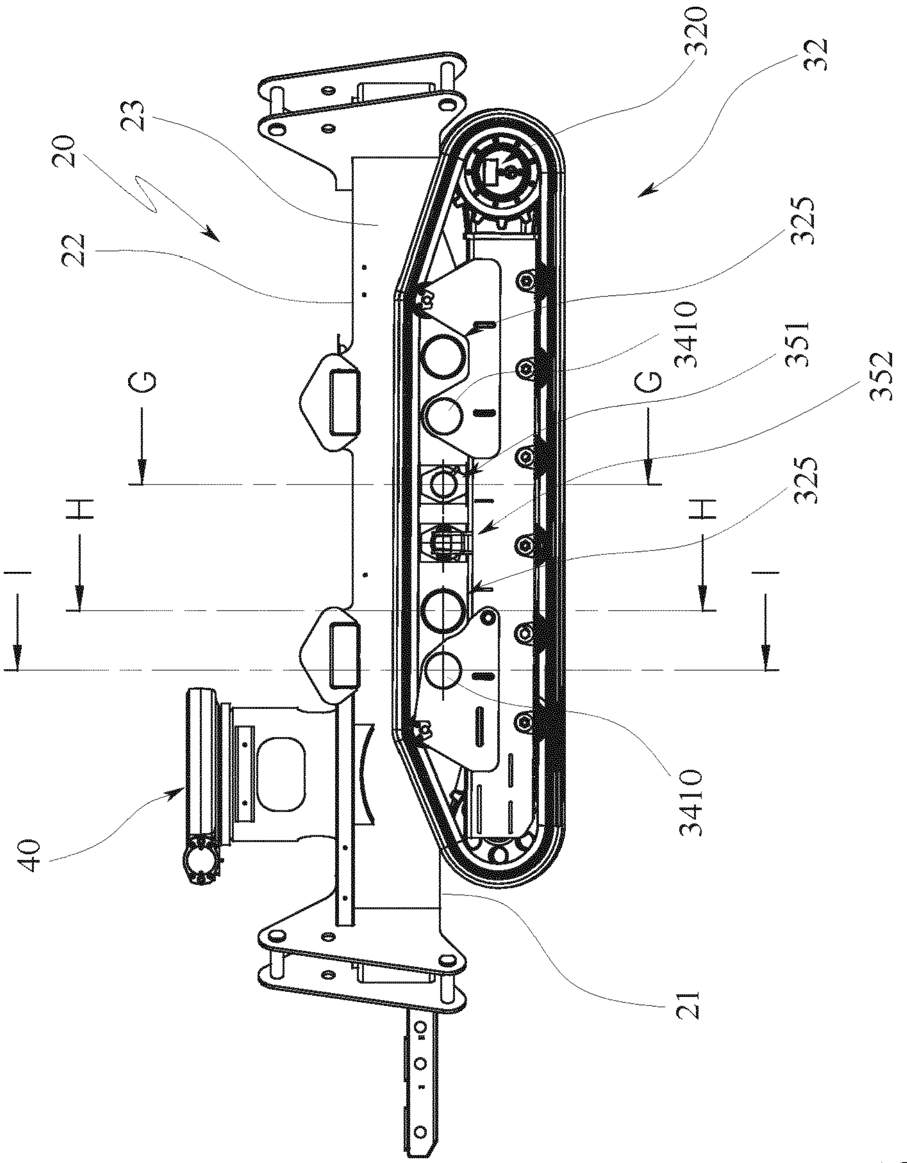


FIG.6

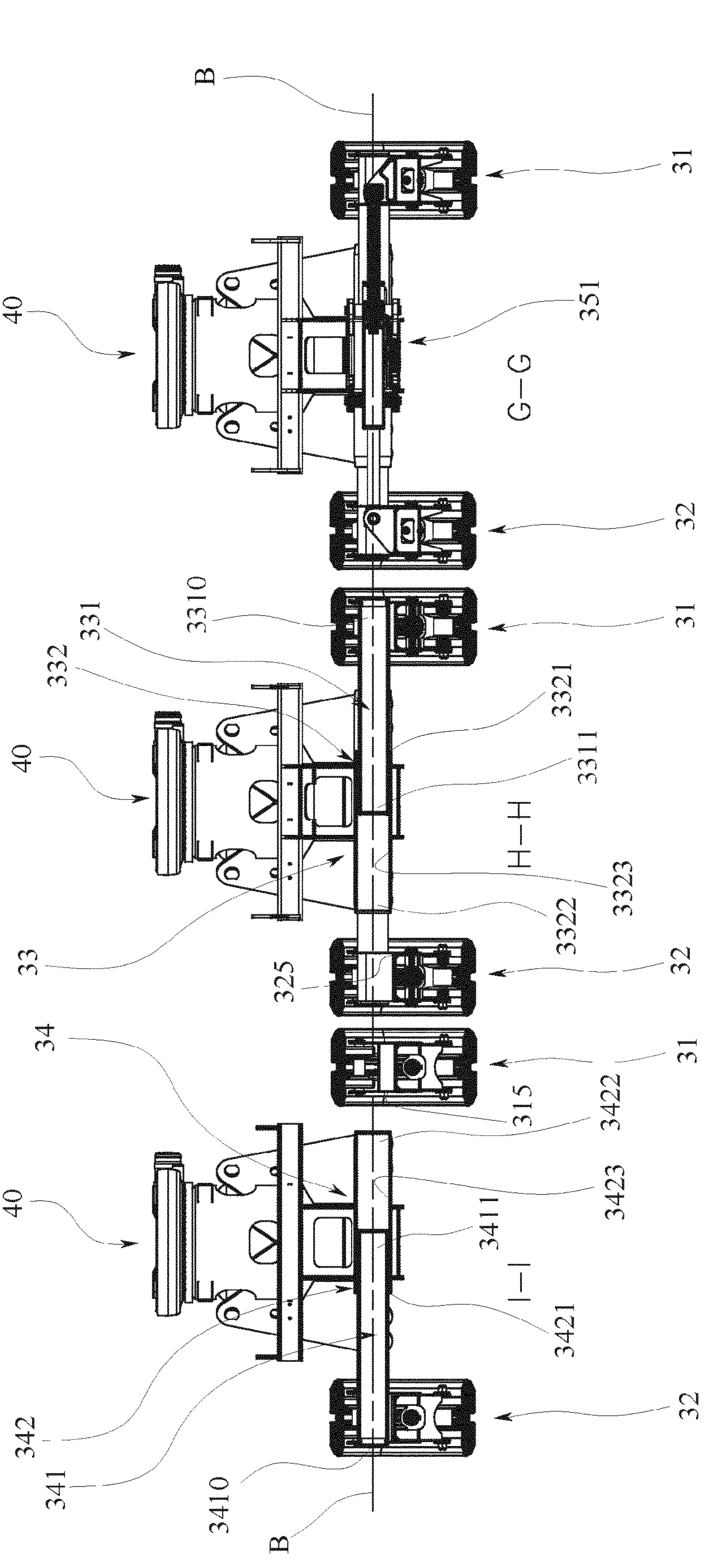


FIG.7A

FIG.7B

FIG.7C

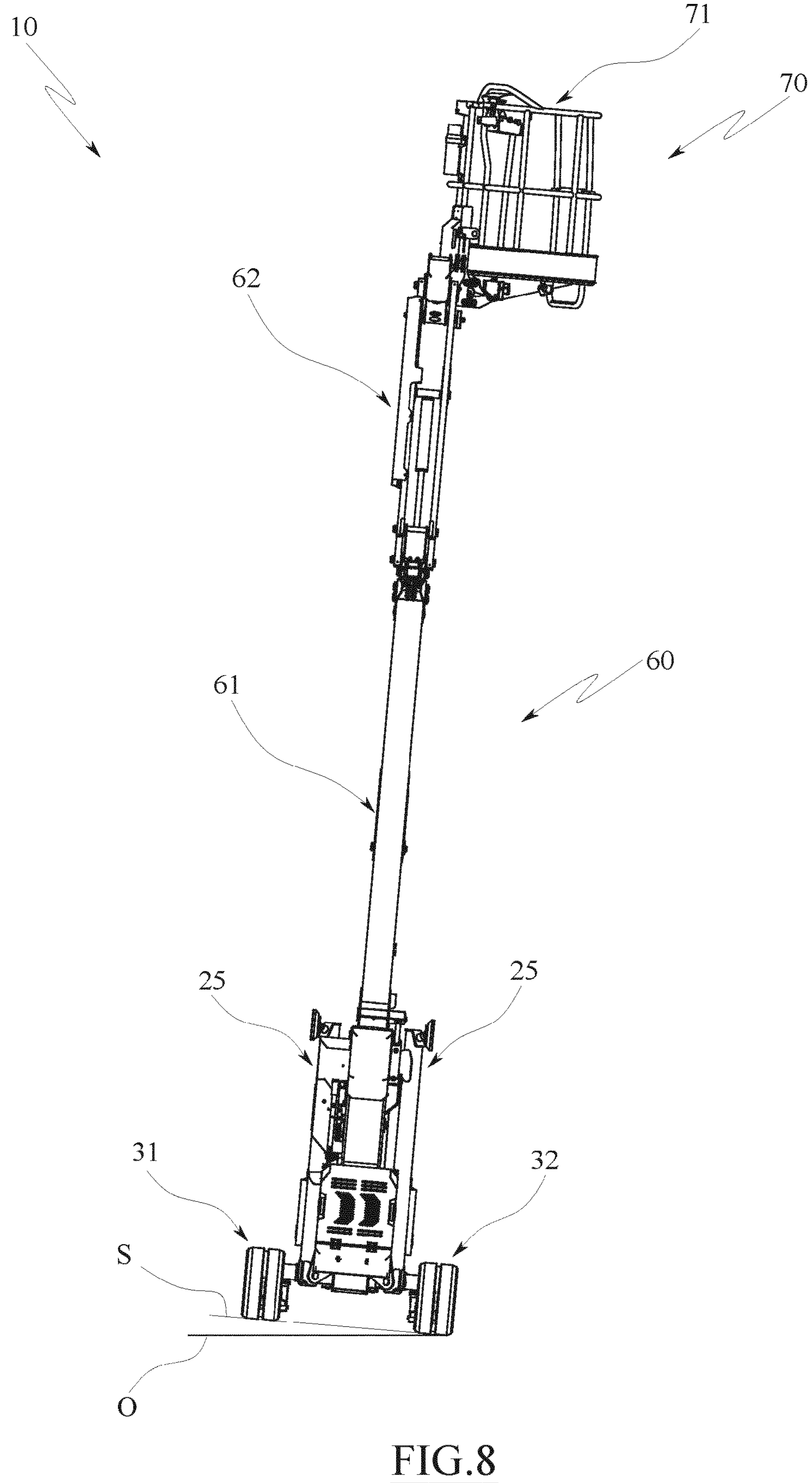


FIG.8

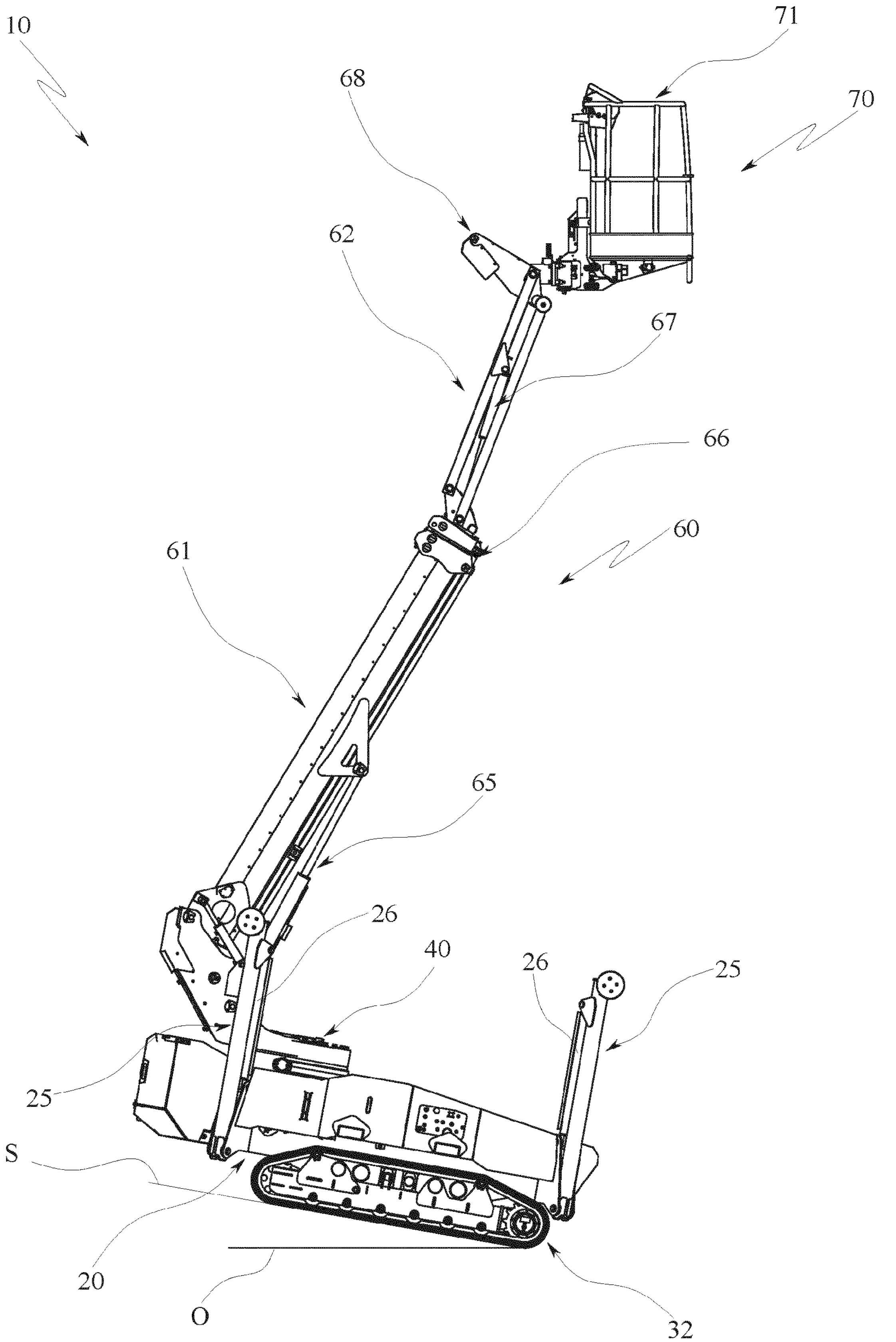


FIG.9A

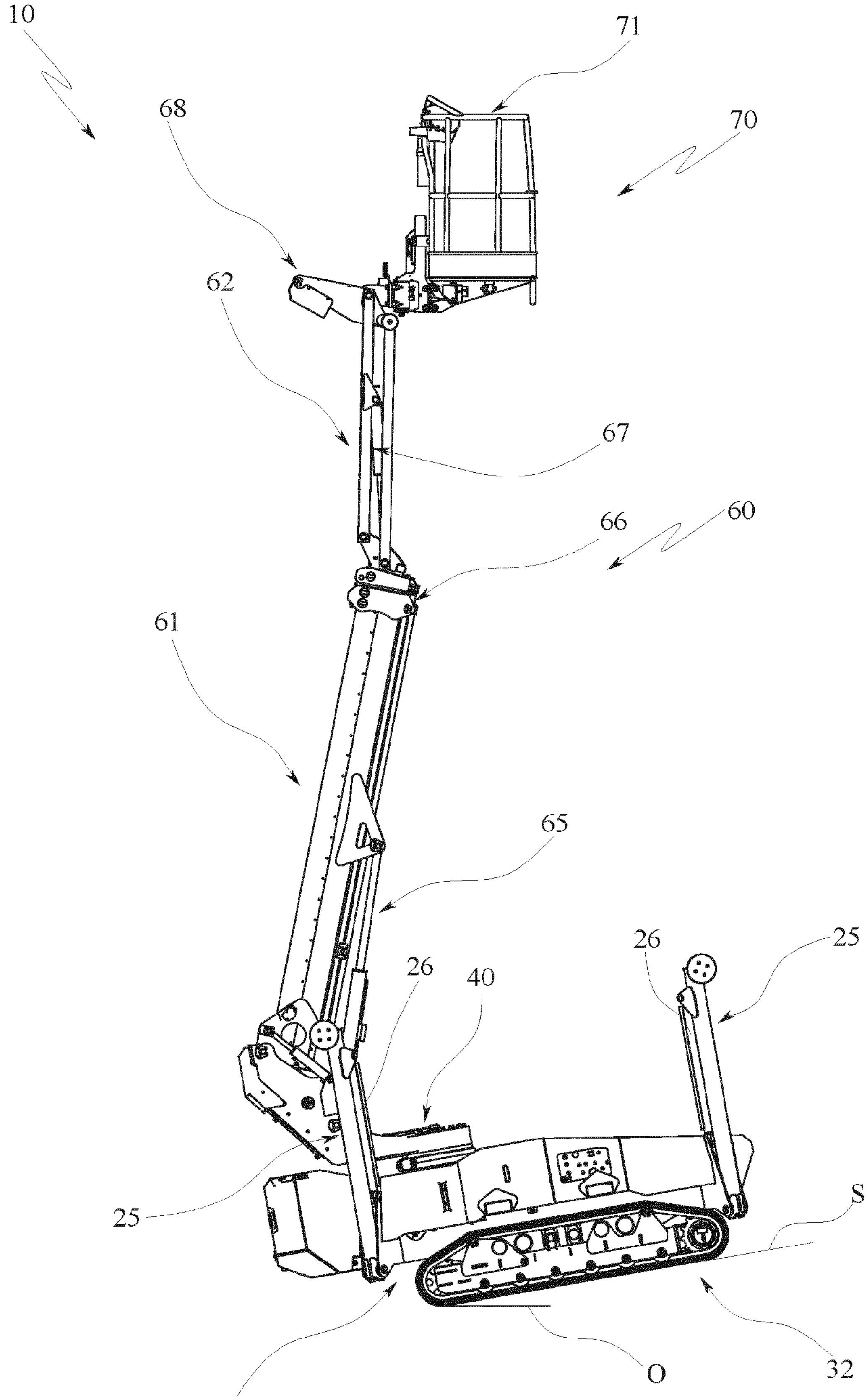


FIG.9B

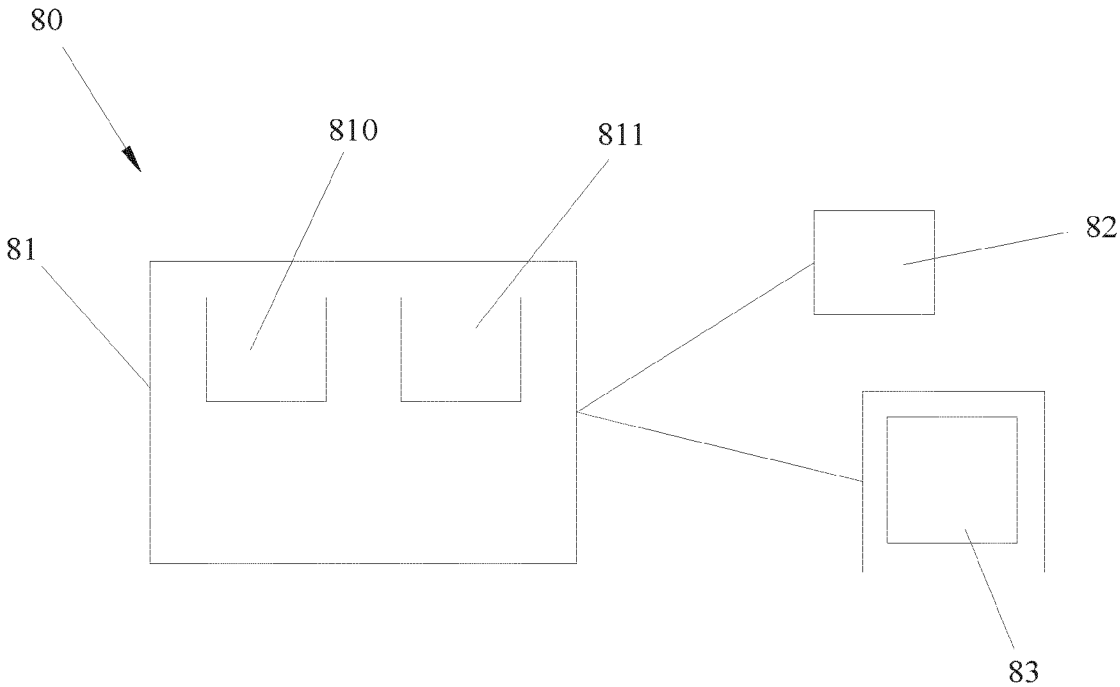


FIG.10

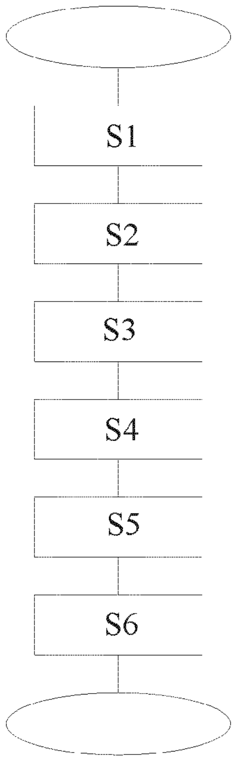
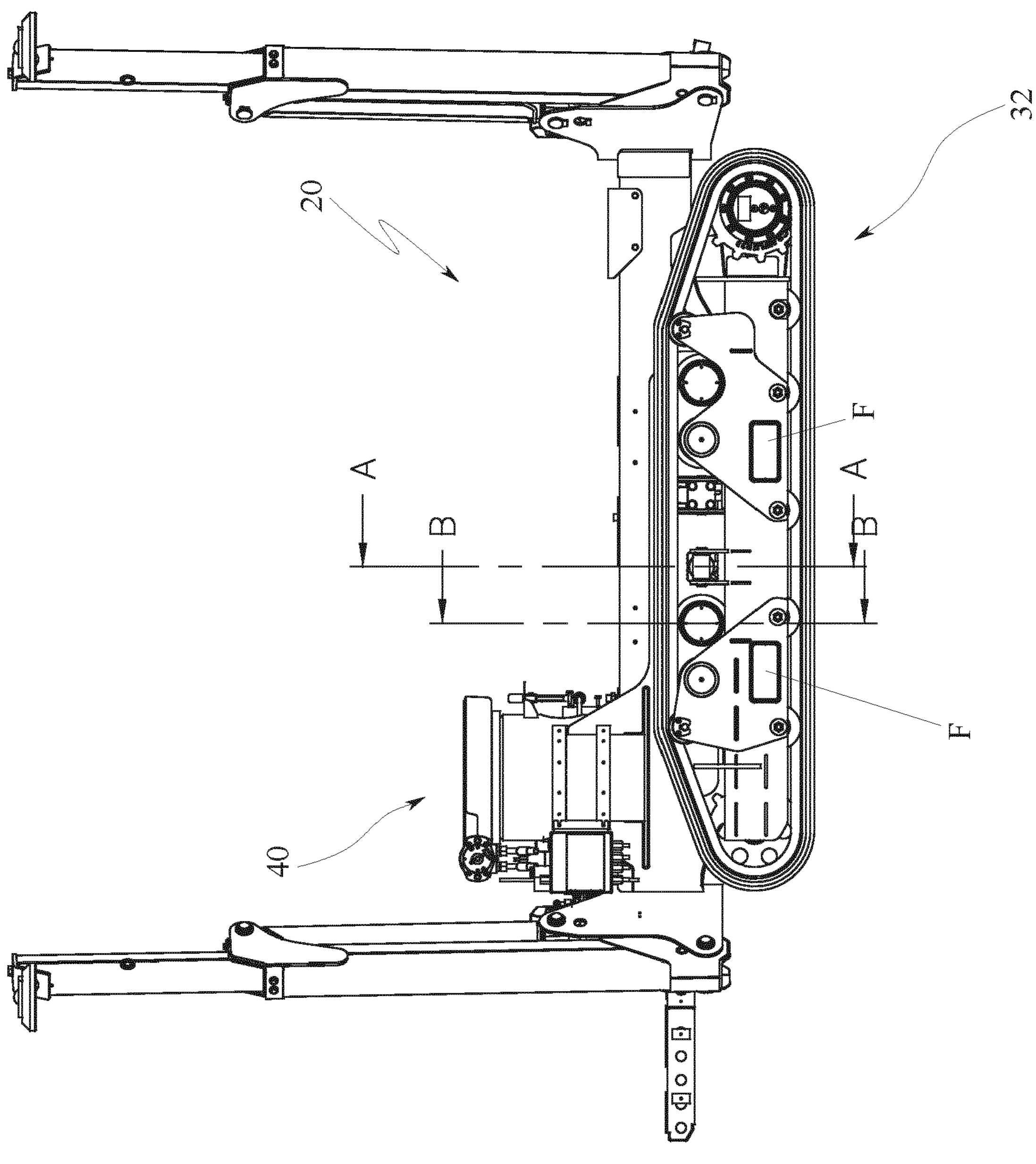


FIG.11

FIG.12



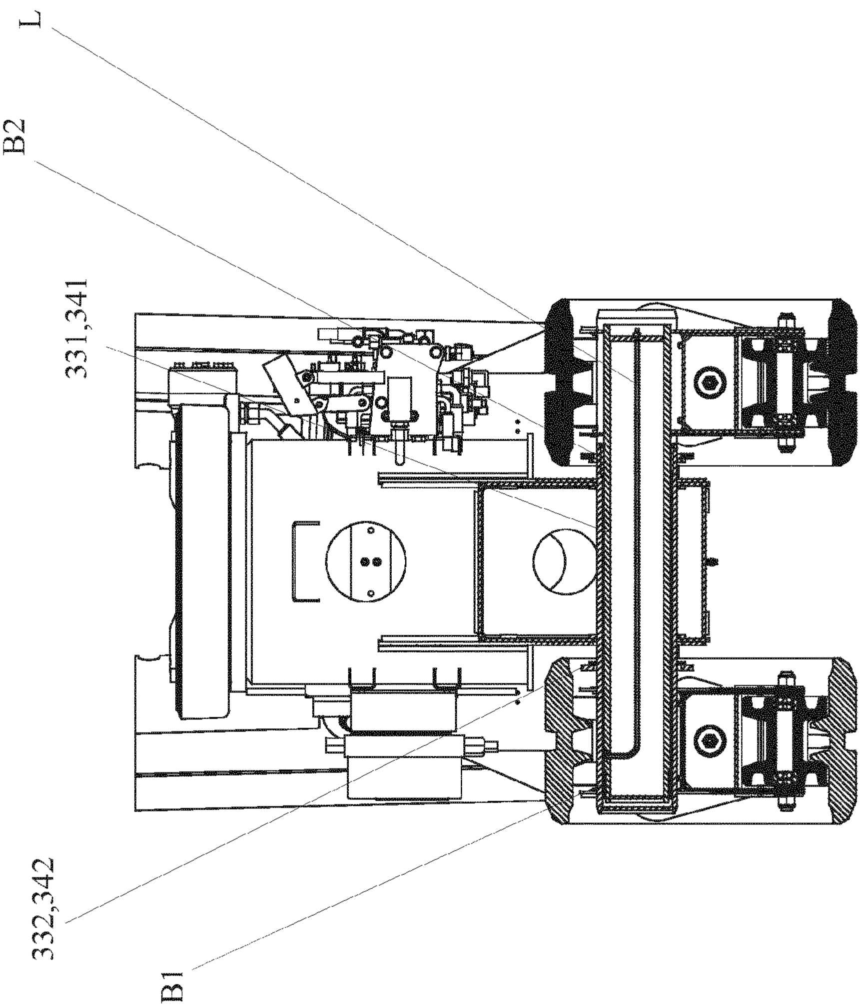


FIG.13B

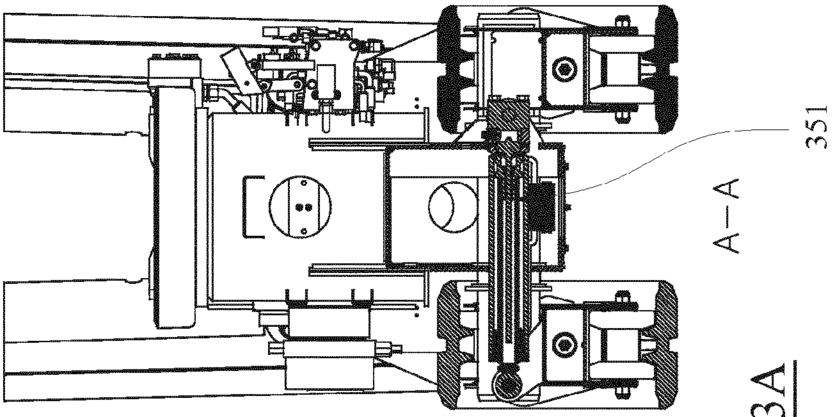


FIG.13A

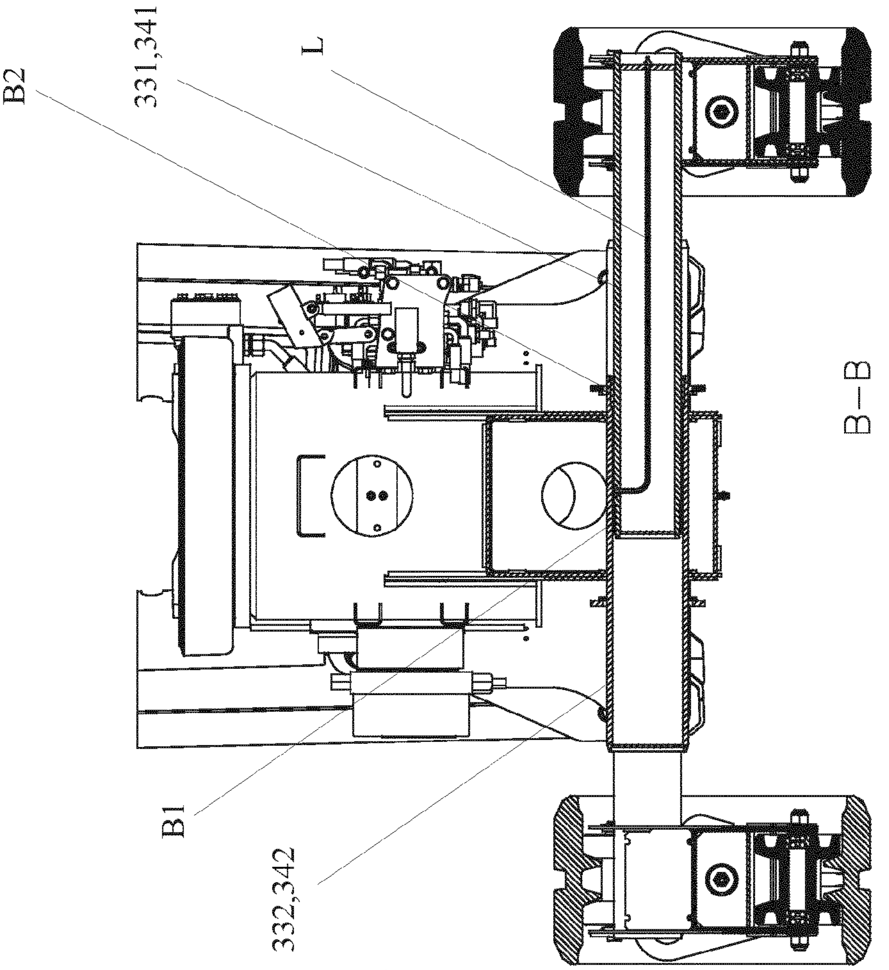


FIG.14B

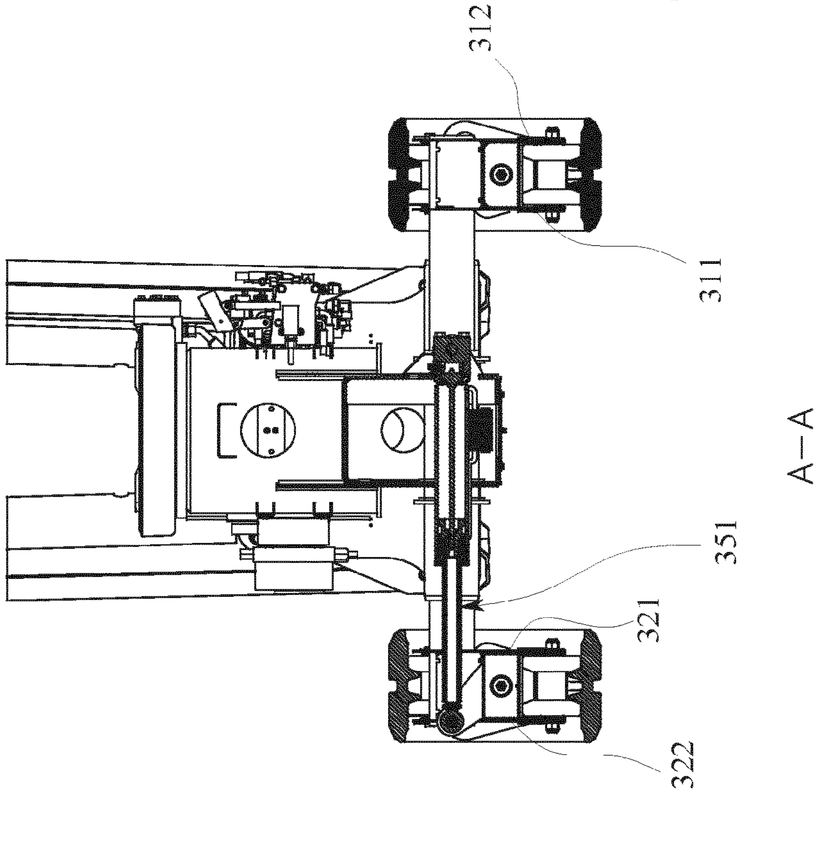


FIG.14A

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EUROPEAN SEARCH REPORT

Application Number
EP 21 19 7918

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 109 573 903 A (JIANGSU EASTMAN HEAVY MACHINERY CO LTD) 5 April 2019 (2019-04-05) * the whole document * -----	1-8	INV. B66F11/04
A	EP 2 687 634 A1 (BAMFORD EXCAVATORS LTD [GB]) 22 January 2014 (2014-01-22) * claims 1,2; figure 5 * -----	1-8	
A	DE 20 47 480 A (RHEINSTAHL AG) 13 April 1972 (1972-04-13) * figures 4,5 * -----	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66F

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 January 2022	Serôdio, Renato

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 19 7918

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17-01-2022

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82