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(54) MOBILE HYDRAULIC CRANE SUPPORTING UNIT, HAVING AN AUTOMATICALLY PIVOTAL SUPPORTING LEG, AND MOBILE HYDRAULIC CRANE, COMPRISING SUCH SUPPORTING UNIT

(57) The purpose of the invention is to conceive a supporting unit (1) for a mobile hydraulic crane (9), which should be furnished with an automatically pivotal supporting leg (2), as well as a mobile hydraulic crane (9), which should comprise such supporting unit (1). Said supporting unit (1) comprises a stationary part (31) and a telescopically movable part (32), which is inserted therein and is displaceable along the longitudinal geometric axis (10) of said supporting unit (1), and on which a hydraulically driven telescopic supporting leg (2) is attached pivotally around said geometric axis (10). The invention provides that by displacing said telescopically movable part (32) relatively to said stationary part (31) along said geometric axis (10), said supporting leg (2) is automatically pivoted. To this aim, a probe assembly (5) is mounted onto said supporting leg (2) and cooperates with a template assembly (4).

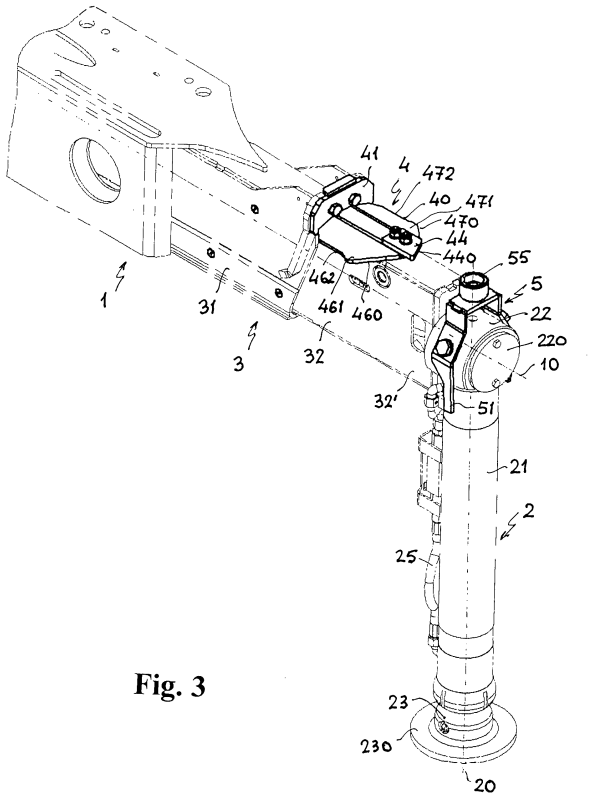

Fig. 3

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Description

[0001] The present invention refers to a mobile hydraulic crane supporting unit, which is furnished with an automatically pivotal supporting leg, namely to a supporting unit of a crane, which is generally mountable onto a land transporting device, which is either an autonomous vehicle driven by its own engine, like a truck, or a vehicle without its own engine, like e.g. a trailer. Said supporting unit generally comprises a guiding assembly and supporting legs. Said guiding assembly comprises a stationary part, which is firmly connected to a crane base, or can also be an integral part thereof, so that the crane as such is in the area of said crane base and/or said supporting unit attached to a vehicle chassis, as well as at least one movable part, which is inserted within said stationary part. Each supporting leg is attached to said movable part and is connected to said guiding assembly pivotally around the longitudinal geometric axis thereof.

[0002] Due to such concept, on the one hand, said guiding assembly is at a suitable distance apart from the ground together with the supporting leg translatory movable to and fro in a horizontal plane and transversally with regard to longitudinal direction of the vehicle, while on the other hand, said supporting leg as such is, at least when being released and positioned at certain distance apart from the ground, pivotal in one or another direction at a pre-determined angle around its pivoting axis, and also telescopically extendable in a direction towards the ground. An object of the invention is also a mobile hydraulic crane, which is furnished with at least one supporting unit, comprising such supporting leg, wherein pursuant to the International Patent Classification such inventions belong to class B 66C 23/80 or B 66C 13/12.

[0003] In this application, the term "mobile hydraulic crane" shall be understood to designate a device, which is suitable for transporting, e.g. (un)loading, lifting or transpositioning of solid pieces or granulated material, wherein such a device is attached to a vehicle chassis or to a chassis of a similar mobile transporting appliance, which is displaceable by land from the first to the second position.

[0004] The chassis of such mobile transporting appliance is normally equipped with wheels, which enable road transporting, but during its operation, such chassis cannot usually provide a sufficient stability thereof, in particular by (un)loading or transposition of some heavier loads. The bearing capability of such device and position of wheels thereof per se usually cannot enable overtaking of loads, which may in certain circumstances exceed the declared carrying capacity of the vehicle as such, so that the crane base, which is mounted onto a vehicle chassis, is usually furnished with a horizontally arranged supporting unit in the form of a relatively complex bearing member, which is telescopically extendable in the area of its guiding member, wherein on its free terminal area there is a supporting leg attached thereto, and wherein said telescopic leg is also telescopically extendable. Said guiding assembly and the belonging supporting leg together form a crane supporting unit. In order to assure efficient supporting of the crane on the both sides of the vehicle, namely in a particular point on the ground outside of the bottom silhouette of the vehicle on each lateral side of the vehicle, the crane is furnished with at least two supporting units, which are arranged either coaxially or in parallel with each other, and are directed apart from each other, wherein each one of said supporting units comprises a guiding assembly and at least one supporting leg. Consequently, as soon as such transporting device is mounted onto a corresponding chassis and is delivered to a desired location, said movable parts of disposable guiding assemblies can be displaced in a direction apart from the vehicle to a desired position, upon which also supporting legs need to be oriented towards the ground and properly extended, upon which a stable supporting thereof on the ground is assured. As soon as supporting legs are rest on the ground, the chassis is actually released, so that at least majority of forces, to which the crane is exposed, are in fact completely transferred to the ground via said supporting legs. A desired number of supporting units is determined on the basis of each particular type of vehicle and crane, namely depending on requirements, which are connected with providing a required stability during lifting and manipulating of each load located at a required distance apart from the chassis. Since said supporting units and also the belonging supporting legs are telescopically conceived, on the one hand the distance among the resting points, in which the loads are transferred to the ground, can be essentially enlarged, by which the vehicle together with the crane mounted thereon is efficiently secured against overturning, while on the other hand, the crane can also be properly levelled, in particular when the ground is not perfectly flat. For example, in mobile hydraulic cranes used in forestry, in most cases a single supporting unit may be sufficient, and such unit is furnished with a pair of guiding assemblies with supporting legs, wherein said guiding assemblies are directed apart from each other and transversally with regard to the longitudinal geometric axis of the vehicle, and wherein each supporting leg may be pivoted from its inactive position, which allows the vehicle to be displaced e.g. by road, into its active position, in which the supporting leg is rest on the ground below the belonging transporting device. Such appliances are known in the prior art and are typically operated by means of a hydraulic circuit, a part of which is integrated within the supporting unit and also in at least one belonging supporting leg, wherein said hydraulic circuit can either be autonomously arranged on the crane as such, or may also be hydraulically connectable with a disposable hydraulic circuit of the vehicle, on which the crane is mounted. Hence, when the crane is mounted onto a vehicle and is in operation, said movable parts of guiding assemblies of supporting units are located at certain height above the ground and displaced in a direction

apart from each other, while each supporting leg, which is available on each of them, is pivoted into its vertical position and is telescopically extended in order to be rest onto the ground. After operation of the crane and prior to relocation thereof to another desired destination, the crane must be prepared for transporting it by land, which is achieved by shortening each supporting leg to its initial length and pivoting it to a suitable position, in which its terminal portion, which is generally suitable for resting onto the ground, is then located at a sufficient distance apart from the ground, upon which also the movable parts of guiding assemblies of supporting units are translatory displaced inwardly, namely in a direction towards the vehicle chassis. To this aim, in most cases pivoting of supporting legs at an angle at 30° or 45° is sufficient, but sometimes the angle needs to be 60°, and if there is enough space in the adjacency of the chassis, a supporting leg may also be pivoted at 90°, rarely even more. Each desired angle of pivoting of a supporting leg depends on a disposable distance between the vehicle chassis and the ground, and also on each disposable space on the vehicle in the adjacency of the chassis, where usually also some other components are mounted, like e.g. a crane operators cockpit, a fuel reservoir, hydraulic equipment, or the like. When the vehicle is ready for driving by road, the width thereof, including the supporting legs thereon, shall not exceed legally admissible width, and the pivoting angle of the legs shall be sufficient that legs are sufficiently distanced apart from the ground in order to allow each required movability of the vehicle.

[0005] The invention is based on a problem, how to conceive a supporting unit of a hydraulic mobile crane, which shall be, similarly like known solutions, firmly connectable with a commonly known hydraulic mobile crane base, or shall represent an integral part of such crane base, and in addition to that, said supporting unit shall comprise a guiding assembly, consisting of a stationary part, which should be directly or indirectly connectable with said crane base, as well as of a movable part, which should be arranged at certain distance above the ground and by means of a suitable hydraulic driving means translatory displaceable to and fro in a direction along the longitudinal geometric axis of the supporting unit, which extends transversally with respect to the longitudinal geometric axis of the vehicle, on which the crane is mounted, wherein a supporting leg shall be pivotally at a pre-determined angle between 15° and 90° in one or another direction around said longitudinal geometrical axis of the supporting unit attached to said movable part of the supporting unit, and each required pivoting of said supporting leg shall be performed automatically and synchronously with displacing of the movable part of the supporting unit along the longitudinal geometric axis of the supporting unit, namely either in a direction towards the vehicle or in a direction away from the vehicle, which should however be realized without any need on essential modifications of existing components on the crane and preferably by means of minimal number of pre-defined, typical and universally usable parts, which shall be as such applicable in various cranes mountable on various vehicles, which are suitable for mounting cranes thereon.

[0006] Hydraulic telescopic legs are known and are commonly used e.g. on mobile hydraulic cranes. A supporting leg, which as such may represent a part of a previously discussed supporting unit, generally comprises an essentially tubular casing, which is closed on the one of its terminal portions, as well as a telescopic arm, which is inserted there-into and is on its free terminal portion equipped with a supporting plate, which provides properly enlarged surface suitable for resting on the ground. A hydraulic cylinder is embedded within said supporting leg, and a part thereof, either a piston or a piston rod, is firmly connected with said casing, or represents and integral part thereof, while the other part of said cylinder is firmly connected with said telescopic arm, or represents an integral part thereof. Said supporting leg casing is pivotally connected to a horizontal beam, which is in fact a telescopic movable part of a guiding assembly of the crane supporting unit and is telescopically movable inserted within a suitable guide, which is either firmly connected with a crane base or represents an integral part of said crane base, wherein the crane is mounted on a vehicle chassis in the area of said crane base and said supporting unit. Said telescopic beam with said supporting leg is in said guide on the stationary part of the guiding assembly displaceable to and fro along a geometric axis, which extends transversely with respect to the longitudinal geometric axis of the vehicle, and is located in a horizontal plane at suitable distance apart from the ground. A crane base, at least in most commercialized cranes, usually comprises two supporting units, and each of them comprises a tubular guide, in which a guiding assembly of the supporting leg is inserted, which is displaceable to and fro along said geometric axis, wherein said guiding assembly is displaceable along said geometric axis by means of a hydraulic cylinder, a part of which, either a piston or a piston rod, is mechanically connected with said guide, while the other part thereof is connected with the beam. The hydraulic cylinder as such is integrated within a hydraulic system of the crane.

[0007] For such purpose, a supporting leg could be used, which is disclosed in EP 3 554 984 B1 and also comprises said telescopically displaceable movable part of the guiding assembly, i.e. a beam, which is inserted within a guide of a stationary part of the guiding assembly of the supporting unit, as well as a supporting leg, which is pivotally attached to said movable part i.e. said beam, and is allowed to be pivoted around the longitudinal geometric axis of said movable part i.e. said beam, which corresponds to the longitudinal geometric axis of the supporting unit as such, wherein said supporting leg is in fact not only pivotal, but in fact rotatable at 360° in one or another direction. However, such supporting leg pursuant to EP 3 554 984 B1 is not freely rotatable, but is driven by means of a rotational hydraulic driving means,

namely a hydraulic cylinder, which is integrated within a pivot joint of the supporting leg on said guiding assembly. Such concept therefore requires, in addition to a hydraulic driving means for displacing of movable part of the guiding assembly and a hydraulic driving unit for extension/retraction of the supporting leg as such, also an additional hydraulic driving means, which must be integrated in the area between the guiding assembly and the supporting leg, and by means of which the supporting leg can be rotated relatively to the guiding assembly, although in practice pivoting of the supporting leg in such a wide range is in fact in most cases unnecessary and may be, in particular on vehicles with limited space available for supporting leg, in fact useless.

[0008] The present invention refers to a mobile hydraulic crane supporting unit, which is furnished with automatically pivotal supporting leg.

[0009] Such supporting unit generally represents an integral part of a crane, which comprises a crane base, in which a column is embedded rotatably around the vertical geometric axis, on the free terminal portion of which a primary arm is pivotally around a horizontal geometric axis attached by one of its terminal portions, while on the other terminal portion of said primary arm a secondary arm is pivotally around the horizontal geometric axis attached thereto by one of its terminal portions, while on the other terminal portion of said secondary arm a grabber is attached, which is pivotal around the horizontal geometric axis and is, when required, also rotatable around the vertical geometric axis. In this, said primary arm is supported by a hydraulic cylinder, which is on the one hand pivotally attached to said column and on the other hand also pivotally to said primary arm, and wherein said secondary arm is also supported by a hydraulic cylinder, which is on the one hand pivotally attached to said primary arm and on the other hand also pivotally to said secondary arm, and wherein said hydraulic cylinders are each per se integrated into a hydraulic system of the crane.

[0010] Said supporting unit as such is adapted for establishing a suitable attachment of the crane onto a vehicle chassis and is either in the area of suitable attachment points firmly connectable with said base of the crane or is conceived as integral part of said base of the crane. Said supporting unit is together with said base of the crane attachable onto a chassis of a vehicle, to which the crane is mountable, so that, upon mounting the crane on the vehicle, the longitudinal geometric axis of the supporting unit is arranged in a horizontal plane above the vehicle chassis and at a pre-determined distance apart from the ground, and is directed transversally with regard to the longitudinal geometric axis of the vehicle, on which said crane is mounted. Moreover, said supporting unit comprises at least one guiding assembly, which is arranged in a horizontal plane and extends in a direction of said longitudinal geometric axis of the supporting unit, and which consists of a stationary part, which is as a part of the supporting unit firmly connectable with the base of the crane, as well as a telescopically movable and properly guided part, which is inserted within said stationary part and is on its free terminal portion furnished with a cylindrical pin, which is arranged coaxially with said longitudinal geometric axis of the supporting unit. Besides, each guiding assembly of the supporting unit comprises at least one hydraulic supporting leg, which is hydraulically integrated within a crane hydraulic system and is telescopically extendable along its longitudinal geometric axis and comprises a casing, which extends along said longitudinal geometric axis and is on its first terminal portion equipped with a bush, while on the second terminal portion thereof a telescopically extendable supporting rod is inserted there-into, which is on its free end portion furnished with a supporting plate, which is suitable for being rest onto the ground. Said bush is placeable onto said cylindrical pin of the movable part of the guiding assembly, so that the supporting leg is by means of said bush placed onto said telescopic movable part of the guiding unit and is then freely pivotal around said longitudinal geometric axis of the supporting unit, wherein it is moreover by means of a suitable protector secured against undesired removal thereof from said telescopically movable part of the guiding assembly.

[0011] The invention proposes that said supporting leg, when placed onto said movable part of the guiding assembly, is furnished with a probe assembly, which comprises a probe, which is directed along said longitudinal geometric axis of the supporting leg and protrudes away from said supporting leg, so that the central geometric axis of said probe is aligned with said longitudinal geometric axis of the supporting leg, as well as a template unit, which is mounted on the stationary part of the guiding assembly and is protruding along said longitudinal geometric axis of the supporting unit in a direction towards the supporting leg, wherein said template unit is adjusted to cooperate with said probe on the supporting leg, when the movable part of the guiding assembly is displaced in a direction towards the interior of the said stationary part of the guiding assembly, or in opposite direction.

[0012] Said template unit of the supporting unit according to the invention is furnished with a peripheral contour, which is adjusted to cooperate with said probe on the bush of the supporting leg and which comprises at least

- a central template, which is arranged centrally on the terminal area of said template unit, which is faced towards the supporting leg, wherein said central template is ended by an inclined terminal edge and is firmly but detachably mounted onto the template unit as such, so that it is generally allowed to be removed and turned over for the purpose of changing orientation of inclination of said terminal edge relatively to the said central geometric axis;
- two separate template sections, which are each per se uniformly conceived and are each per se arranged on the one of both sides of said template,

and are moreover also each per se inclined at a predetermined angle relatively to said longitudinal geometric axis of the supporting unit, wherein both template sections are arranged to form an arrow-like shape on the template unit and extend in the form of letter V, diverging in a direction away from the supporting leg;

- two arresting sections, which are each per se substantially linear and extend at a distance apart from each other substantially in parallel with said longitudinal geometric axis of the supporting unit, and are therefore also arranged such that each one of them is located on the one of both lateral sides of said template in the area between said template sections and the stationary part of the guiding assembly as such; as well as
- two smoothly rounded and widened transitions, by means of which each of said template section is continuously, in particular without any steps or other discontinuations, connected with each belonging arresting section, wherein the width of the template unit in the area of said transitions is larger than the width thereof in the area of said arresting sections.

[0013] Generally, each of said template sections, which are each per se continuous, can be is either straight, or may also be convex, namely deflected outwardly towards said terminal edge of the template, or may also be concave, namely deflected inwardly in a direction towards the stationary part of the guiding assembly i.e. away from said terminal edge of the template.

[0014] Accordingly, by each displacement of the movable part of the guiding assembly of the supporting unit on a crane in a direction towards the interior of the belonging stationary part thereof, said probe on the supporting leg is initially rest on the inclined terminal edge of the central template and is by sliding along said inclined terminal edge displaced to each belonging inclined template section, and is upon that, via a corresponding rounded transition displaced to the belonging arresting section, wherein however it is also displaceable in opposite direction and in reciprocal sequence, whenever the movable part of the guiding assembly of the supporting unit on a crane is retracted outwardly from the stationary part thereof in the opposite direction.

[0015] In a preferred embodiment of the invention, said template is attached onto said template unit by means of screws. The template unit as such is formed on a beam, which is firmly, but generally in a detachable manner, connectable with said stationary part of the guiding assembly of the supporting unit of the crane. Said probe is generally conceived as a rigid cylindrical protrusion, which extends along its geometric axis aligned with longitudinal geometric axis of the supporting leg, and which is firmly connected with the bearing member, which is by means of screws firmly, but detachably, attached to said bush on the supporting leg. In accordance with a preferred embodiment of the invention, however, said probe is conceived as a rigid cylindrical protrusion, which extends along its geometric axis aligned with longitudinal geometric axis of the supporting leg, and which is furnished with an around said protrusion freely rotatable rolling member. In this, said probe as such is firmly connected with the bearing member, which is by means of screws firmly, but detachably, attached to said bush on the supporting leg.

[0016] In one of the embodiments of the invention, said supporting unit comprises a single guiding assembly with a supporting leg, which is pivotal around the longitudinal geometric axis of the supporting unit.

[0017] According to another embodiment of the invention, said supporting unit comprises two guiding assemblies, which are arranged substantially in a direction of the longitudinal geometric axis of the supporting unit and are oriented in opposite directions apart from each other, wherein each of them is furnished with a supporting leg, which is pivotal around the longitudinal geometric axis of the supporting unit, and wherein both guiding assemblies are arranged in the same horizontal plane. It is however possible that, either both apart from each other protruding guiding assemblies each per se extend in a direction along the longitudinal geometric axis of the supporting unit and are arranged coaxially with each other, or both apart from each other protruding guiding assemblies each per se extend in a direction along the longitudinal geometric axis of the supporting unit, but are arranged adjacent to each other in the same horizontal plane, and extend in parallel to each other.

[0018] The present invention further refers to a mobile hydraulic crane, which comprises a crane base, a column, which is rotatably around a vertical geometric axis embedded in said crane base, a primary arm, which is with its first terminal portion pivotally around the horizontal geometric axis attached to the free terminal portion of said column, a secondary arm, which is with its first terminal portion pivotally around the horizontal geometric axis attached to the second terminal portion of said primary arm, as well as a grabber, which is pivotally around the horizontal geometric axis and, when required, also rotatably around the vertical geometric axis, attached to the second terminal portion of said secondary arm, wherein said primary arm is supported by a hydraulic cylinder, which is pivotally attached on the one hand to said column and on the other hand to said primary arm, and wherein said secondary arm is supported by a hydraulic cylinder, which is pivotally attached on the one hand to said primary arm and on the other hand to said secondary arm, wherein said hydraulic cylinders are hydraulically connectable to the hydraulic circuit of the crane.

[0019] In accordance with the proposed invention, such crane, in addition to said crane base, further comprises at least one supporting unit, which is furnished with at least one supporting leg, and is adjusted to be mounted onto a vehicle chassis, and which is either in the area of suitable connecting points firmly connectable with said

crane base, or is on the crane conceived as an integral part of said crane base, wherein said supporting unit includes all previously described features, which have been disclosed in the previous description of the supporting unit.

[0020] The invention will be explained in detail on the basis of embodiments presented in the attached drawings, wherein

Fig. 1 is showing an embodiment of a known mobile hydraulic crane, on which an automatically pivotal supporting unit according to the invention is applied, in front view;

Fig. 2 is showing a supporting unit of a crane according to Fig. 1, presented in a cross-section along the vertical plane and along the geometrical axis, along which a supporting leg of said supporting unit is displaceable, and is also pivotal around it;

Fig. 3 is showing a schematically and in isometric view presented supporting unit according to the invention;

Fig. 4 is showing a supporting unit according to Fig. 3 in explosion view;

Fig. 5 is showing a probe assembly of said supporting unit according to Fig. 3 or 4 in isometric view;

Fig. 6 is showing a template assembly of said supporting unit according to Fig. 3 or 4 in isometric view;

Fig. 7 is showing said supporting unit according to Fig. 3 or 4 in front view;

Fig. 8 is showing said supporting unit according to Fig. 3 or 4 in side view;

Fig. 9 is showing said supporting unit according to Fig. 3 or 4 in top view;

Fig. 10 is showing said guiding assembly, adjusted for pivoting of a supporting leg at a pre-determined angle in a desired direction:

Fig. 11 is showing a supporting leg, furnished with a guiding assembly according to Fig. 10, in top view;

Fig. 12 is showing a supporting leg, furnished with said guiding assembly according to Fig. 10, in side view;

Fig. 13 is showing a supporting leg, furnished with the guiding assembly according to Fig. 10, in front view;

Fig. 14 is showing said guiding assembly, which is however adjusted for pivoting of said supporting leg at a pre-determined angle in opposite direction as the guiding assembly according to Fig. 10;

Fig. 15 is showing a supporting leg, furnished with a guiding assembly according to Fig. 14, in top view;

Fig. 16 is showing a supporting leg, furnished with said guiding assembly according to Fig. 14, in side view; and

Fig. 17 is showing a supporting leg, furnished with the guiding assembly according to Fig. 14, in front view.

[0021] A crane 9 according to Fig. 1 is a mobile hydraulic crane, comprising a crane base 91 with a supporting unit 1. A column 92 is rotatably around a vertical geometric axis 901 embedded on said crane base 91, and a primary arm 93 is with its first terminal portion pivotally around the horizontal geometric axis 902 attached to the free terminal portion of said column 92. Said primary arm 93 is supported by a hydraulic cylinder 923, which is pivotally attached on the one hand to said column 92 and on the other hand to said primary arm 93. A secondary crane arm 94 is with its first terminal portion pivotally around the horizontal geometric axis 903 attached to the second terminal portion of said primary arm 93. A grabber 95 is pivotally around the horizontal geometric axis 905, and in the shown embodiment also rotatably around the vertical geometric axis 904, attached to the second terminal portion of said secondary arm 94. Said secondary arm 94 is pivotal relatively to said primary arm 93 by means of a hydraulic cylinder 934, which is pivotally attached on the one hand to said primary arm 93 and on the other hand to said secondary arm 94.

[0022] Said crane base 91 comprises on the one hand a bearing assembly, which is not shown in the drawing, and which is intended for assuring a stable engagement of said column 92, which is conceived as cantilever and is, in addition to that, also rotatable around the vertical geometric axis 901, and on the other hand also a driving mechanism, which is capable to generate forces, which are required for establishing of a sufficient torque, which is required for rotating said column 91 around said vertical geometric axis 901. Moreover, said crane base 91 also comprises sufficiently strong attachment means, by means of which the crane 9 is firmly attached to a not-shown vehicle chassis. Besides, said crane base 91 is also adapted for establishing of an efficient and reliable connection with the supporting unit 1, which is shown in Figs 2 - 4. Attachment points 101',101" for providing such interconnection between said crane base 91 and said supporting unit 1, which may generally be performed in a detachable manner, is shown in Fig. 4.

[0023] Said supporting unit 1 according to Fig. 4 comprises a telescopically conceived guiding assembly 3, which is as such presented in Fig. 2 and consists of a stationary part 31, which is firmly connectable with said crane base 91, as well as of a movable part 32, which is telescopically inserted and guided within said stationary part 31 and is by means of a hydraulic cylinder 33 displaceable along the longitudinal geometric axis 10 of the supporting unit 1. Said hydraulic cylinder 33 is hydraulically integrated in a hydraulic circuit of the crane 9. Said movable part 32 is on its free terminal portion 32' furnished with a cylindrical pin 320, which is arranged coaxi-

ally with said longitudinal geometric axis 10 of the supporting unit 1, and on which a supporting leg 2 is mounted pivotally around said longitudinal geometric axis 10.

[0024] Accordingly, the supporting unit 1 is furnished with said supporting leg 2, which comprises a casing 21, which is on its first terminal portion 21', which is faced towards the guiding assembly 3, equipped with a bush 22, which is firmly connected to said casing 21 and is adjusted to be tightly placed onto said cylindrical pin 320 on the guiding assembly 3, upon which the supporting leg 2 is freely pivotal at a pre-determined angle in one or another direction around said pin 320 and also around said geometric axis 10. Moreover, said bush 22 is in the shown embodiment by means of a suitable protector 220 secured against undesired removal thereof from said cylindrical pin 320. A telescopically extendable supporting rod 23 is inserted into said casing 21 on the secondary terminal portion 21" thereof, and is on its free terminal portion furnished with a supporting plate 230, which is suitable for being rest onto the ground. In the shown embodiment, said casing 21 of the supporting leg 2 is in fact a hydraulic cylinder casing, and the supporting rod 23 is in fact an integral part of a piston rod, which is adjusted to cooperate with said hydraulic cylinder. A hydraulic circuit, required for driving said hydraulic cylinder, is via hydraulic conduits 25 hydraulically integrated into the hydraulic system of the crane 9.

[0025] Within the context of resolving the previously mentioned technical problem, a template assembly 4 is mounted on said stationary part 31 of the guiding assembly 3, and is adjusted to cooperate with a probe assembly 5, which is mounted on said bush 22 on the supporting leg 2 and therefore actually on said movable part 32 of the guiding assembly 3. Said template assembly 4 is generally formed in such manner that a proper interaction thereof with said probe assembly 5 is assured during the pivoting of said supporting leg 2 around said longitudinal geometric axis 10 of the supporting unit 1.

[0026] Said probe assembly 5 comprises a bearing member 51, which is in the shown embodiment according to Figs. 4 and 5 by means of screws firmly attached to said bush 22 on the supporting leg 2, as well as a probe 55, which is arranged in a longitudinal geometric axis 50, which either coincides with geometric axis 20 of the supporting leg 2, or is optionally arranged parallel it. Said probe 55 generally comprises a rigid cylindrical pin 55', which is arranged coaxially with said geometric axis 50 and is attached on said bearing member 51. Said pin 55' of the probe 55 is adjusted to be rest onto a contour of said template assembly 4 and displaced along it. In a preferred embodiment (Fig. 5), said probe 55 is furnished with a roller member 550, which is freely rotatably around said geometric axis 50 placed on said bearing member 51, namely on the circumference of the probe 55 as such, so that the friction, which occurs due to interaction between the probe assembly 5 and template assembly 4, may be essentially reduced, by which the functional reliability is improved and the lifetime of both previously mentioned assemblies 4, 5 may be essentially prolonged.

[0027] Said template assembly 4 generally consists of a bearing member 41, by means of which said template assembly 4 is firmly connected with the stationary part 31 of the guiding assembly 3 of the supporting unit 1 of the crane 9. In the shown embodiment (Figs. 4 and 6), said connection is established by means of screws 411, 412. A template unit 40, which extends in a direction along said geometric axis 10 of the supporting unit 1 and protrudes towards said probe assembly 5 on the bush 22 of the supporting leg 2, is firmly connected to said bearing member 41 and therefore also to said stationary part 31. Said template unit 40 comprises a central area 401, to which a central template 44 is attached in its terminal portion 401' faced towards the supporting leg 2, wherein the terminal edge 440 of said central template 44, which is faced towards said supporting leg 2, is formed inclined with respect to said longitudinal geometric axis 10. In the shown embodiment, said central template 44 is attached to said template unit 40 in a detachable manner by means of screws 45', 45", and can therefore be removed and turned, upon which said terminal edge 440 of the central template 44 is still faced towards the supporting leg 2, but orientation of its inclination relative to said longitudinal geometric axis 10 of the supporting unit 1 is changed. Moreover, on the terminal portion of the template unit 40, which is faced towards the probe assembly 5, a lateral directing contour is formed on each side of said central template 44. Each one of said lateral directing contours comprises an uniform template section 460, 470, which is arranged adjacent to said central template 44 and extends inclined with respect to said longitudinal geometric axis 10 of the supporting unit 1, and is via a slightly rounded transition 461, 462 continued by a linear arresting section 462, 472. Said template sections 460, 470 are arranged to form an arrow-like shape on the template unit 40 and extend in the form of letter V, which diverges in a direction away from the supporting leg 2. In the shown embodiment according to Figs 3 - 6, 9 - 11 ,or 13 and 14, said template sections 460, 470 are each per se linear. But in general, each of said template sections 460, 470 may also be formed either as a convex section, which is deflected outwardly in a direction towards said terminal edge 440 of the central template 44, or as a concave section, which is deflected inwardly towards said stationary part 31 of the guiding assembly 3, i.e. away from said terminal edge 440 of the central template 44. Said slightly rounded transitions 461, 471 represent the widest area of said template unit 40, while said arresting sections 462, 472 in fact represent opposite lateral edges of said template unit 40, which extend parallel with each other and also with said longitudinal geometric axis 10, wherein the distance between said arresting sections 462, 472 in a direction transversely with respect to said longitudinal geometric axis 10 is smaller than the width of the template unit 40 in the area of said slightly rounded transitions 461, 462.

[0028] As soon as the template assembly 4 is mounted onto said stationary part 31 of the guiding assembly of the supporting unit of the crane 9, and the probe assembly 5 is mounted on said supporting leg 2, namely on said telescopically movable part 32 of the guiding assembly of the crane 9, by each movement of said movable part 32 towards the crane base 9 the contact is established between the probe 55 of the probe assembly 5 on the supporting leg 2 and the template assembly 4 on said stationary part 31 of the guiding assembly 3 of the supporting unit 1 of the crane 9. As mentioned, the supporting leg 2 as such is freely pivotal at least at a pre-determined angle due to its bush 22, which is freely pivotally placed on said pin 320, so that the supporting leg 2 tends, due to its weight, automatically to move towards a position, in which its longitudinal geometric axis 20, in which also said probe 55 is arranged, extends vertically. This however means that during each movement of said telescopic movable part 32 in a direction towards the stationary part 31, said probe 55 initially arrives in contact with the inclined terminal edge 440 of the central template 44. During subsequent movement of said telescopic movable part 32 in a direction towards the stationary part 31, a direction, in which the supporting leg 2 is pivoted around said longitudinal geometric axis 10, is determined by orientation of inclination of said terminal edge 440 (Figs 10 - 13 and 14 - 17). As mentioned, said direction of pivoting of the supporting leg 2 can also be changed, if desired, which may be achieved by simply releasing screws 45', 45" and turning over the central template 44 (Figs 10 and 14), upon which the orientation of inclination of the terminal edge 440 relatively to said longitudinal geometric axis 10 is changed. By still further displacing of the telescopic movable part 32 in a direction towards the stationary part 31, the probe 55 is forced to leave the terminal edge 440 of said central template 44 and becomes rest onto a corresponding template section 460, 470 and continues moving there-along, upon which its displacement is continued over the belonging slightly rounded transition 461, 471, and is concluded in the area of a corresponding arresting section 462, 472 (Figs. 10 - 13 and 14 - 17). The angle and velocity of pivoting of the supporting leg 2 around said geometric axis 10 and also relatively with respect to said vertical geometric axis 901 of the crane 9 perpendicularly to the ground depend on inclination and length of each relevant template section 460, 470. As soon as the probe 55 is displaced over corresponding transition 461, 471, pivoting of the supporting leg 2 is substantially concluded, and as soon as the probe 55 reaches the corresponding arresting section 462, 472, the supporting leg 2 is secured in its correspondingly pivoted position, in which it is inclined at a predetermined angle with respect to vertical direction, e.g. relative to said vertical geometric axis 901 of the crane 9, or also relatively to the horizontal plane corresponding to e.g. said horizontal geometric axis 10 of the supporting unit 1, wherein the supporting leg 2 is also prevented from undesired returning back to its initial position either due its weight or due to any other undesired circumstances. When however the telescopic movable part 32 is moved in opposite direction, namely in a direction away from the stationary part 31, the probe 55 is displaced in opposite direction along said sections 462, 472; 461, 471; 460, 470 of the template unit 40 contour up to the terminal edge 440 of the central template 4, where the contact between the probe 55 and the template assembly 4 can be generally dismissed, upon which the supporting leg 2 is due its weight pivoted to its vertical position rectangular to the ground.

[0029] Each person skilled in the art should understand that in practice a relatively small number of different typical template units 40 may be quite sufficient that, when combining each one of them with an universally applicable central template 44, all practically needed pivoting angles of the supporting leg 2 in one or another direction may be achieved, e.g. 30°, 45°, 60°, 75°, 90°, maybe even just 45° and 90°, which includes various combinations of cranes 9 with supporting legs 2 and various vehicles, on which such cranes 9 are mountable.

Claims

1. Mobile hydraulic crane (9) supporting unit (1), having an automatically pivoted supporting leg (2) and being suitable for supporting of such a crane (9), which comprises a crane base (91), in which a column (92) is embedded rotatably around the vertical geometric axis (901), on the free terminal portion of which a primary arm (93) is pivotally around a horizontal geometric axis (902) attached by one of its terminal portions, while on the other terminal portion of said primary arm (93) a secondary arm (94) is pivotally around the horizontal geometric axis (903) attached by one of its terminal portions, while on the other terminal portion of said secondary arm (94) a grabber (95) is attached, which is pivotal around the horizontal geometric axis (905) and, when required, also around the vertical geometric axis (904), wherein said primary arm (93) is supported by a hydraulic cylinder (923), which is on the one hand pivotally attached to said column (92) and on the other hand pivotally to said primary arm (93), and wherein said secondary arm (94) is supported by a hydraulic cylinder (934), which is on the one hand pivotally attached to said primary arm (93) and on the other hand pivotally to said secondary arm (94), and wherein said hydraulic cylinders (923, 934) are, each per se, integrated in a hydraulic system of the crane (9),

   wherein said supporting unit (1) is adapted for establishing of a suitable attachment of the crane (9) onto a vehicle chassis and is either in the area of suitable attachment points (101', 101") firmly connectable with said base (91) of

the crane (9) or is conceived as integral part of said base (91) of the crane (9),
and wherein said supporting unit (1) is together with said base (91) of the crane (9) attachable onto a chassis of a vehicle, to which the crane (9) is mountable, so that, upon mounting of the crane (9) on the vehicle, the longitudinal geometric axis (10) of the supporting unit (1) is arranged in a horizontal plane above the vehicle chassis and at a pre-determined distance apart from the ground, and is directed transversally with regard to the longitudinal geometric axis of the vehicle, on which said crane (9) is mounted, and wherein said supporting unit (1) comprises at least one guiding assembly (3), which is arranged in a horizontal plane and extends in a direction of said longitudinal geometric axis (10) of the supporting unit (1), and which consists of a stationary part (31), which is as a part of the supporting unit (1) firmly connectable with the base (91) of the crane (9), as well as a guided telescopically movable part (32), which is inserted within said stationary part (31) and is on its free terminal portion (32') furnished with a cylindrical pin (320), which is arranged coaxially with said longitudinal geometric axis (10) of the supporting unit (1),
and wherein each guiding assembly (3) of the supporting unit (1) comprises at least one hydraulic supporting leg (2), which is hydraulically integrated within a crane hydraulic system and is telescopically extendable along its longitudinal geometric axis (20) and comprises a casing (21), which extends along said longitudinal geometric axis (20) and is on its first terminal portion (21') ended with a bush (22), while on the second terminal portion (21") a telescopically extendable supporting rod (23) is inserted, which is on its free end portion furnished with a supporting plate (230), which is suitable for being rest onto the ground, wherein said bush (22) is placeable onto said cylindrical pin (320) of the movable part (32) of the guiding assembly (3), such that the supporting leg (2) is by means of said bush (22), when placed onto said telescopic movable part (32) of the guiding unit (3), is freely pivotal around said longitudinal geometric axis (10) of the supporting unit (1), and is moreover by means of a protector (220) secured against undesired removal thereof from said telescopically movable part (32) of the guiding assembly (3), **characterized in that** said supporting leg (2), when placed onto said movable part (32) of the guiding assembly (3), is furnished with a probe assembly (5), which comprises a probe (55), which is directed along said longitudinal geometric axis (20) of the supporting leg (2) and protrudes away from said supporting leg (2), so that the central geometric axis (50) of said probe (55) is aligned with said longitudinal geometric axis (20) of the supporting leg (2), as well as a template unit (40), which is mounted on the stationary part (31) of the guiding assembly (3) and is protruding along said longitudinal geometric axis (10) of the supporting unit (1) in a direction towards the supporting leg (2), so that said template unit (40) is adjusted to cooperate with said probe (55) on the supporting leg (2) when the movable part (32) of the guiding assembly (3) is displaced in a direction towards the interior of the stationary part (31) thereof, or in opposite direction, wherein said template unit (40) is furnished with a peripheral contour, which is designed to cooperate with said probe (55) on the bush (22) of the supporting leg (2) and which comprises at least

- a central template (44), which is arranged in the terminal area (401) of said template unit (40), which is faced towards the supporting leg (2), wherein said central template (44) is ended by an inclined terminal edge (440) and is firmly but detachably mounted onto the template unit (40) as such, so that it is allowed to be removed and turned over for the purpose of changing orientation of inclination of the terminal edge (440) relatively to the said central geometric axis (10);
- two separate template sections (460, 470), which are each per se uniformly conceived and are each per se arranged on the one of both sides of said central template (44), and are moreover also each per se inclined at a pre-determined angle relatively to said longitudinal geometric axis (10) of the supporting unit (1), wherein said template sections (460, 470) are arranged to form an arrow-like shape on the template unit (40) and extend in the form of letter V, diverging in a direction away from the supporting leg (2);
- two arresting sections (462, 472), which are each per se substantially linear and extend at a distance apart from each other substantially in parallel with said longitudinal geometric axis (10) of the supporting unit (1), and are therefore also arranged such that each one of them is located on the one of both sides of said central template (44) in the area between said template sections (460, 470) and the stationary part (31) of the guiding assembly (3) as such; as well as
- two smoothly rounded and widened transitions (461, 462), by means of which each

one of said template sections (460, 470) is continuously, in particular without any steps or other discontinuations, connected with each belonging arresting section (462, 472), so that the width of the template unit (40) in the area of said transitions (461, 471) is larger than the width thereof in the area of said arresting sections (462, 472);

so that, by displacement of the movable part (32) of the guiding assembly (3) of the supporting unit (1) on a crane in a direction towards the interior of the belonging stationary part (31) thereof, said probe (55) on the supporting leg (2) is initially rest on the inclined terminal edge (440) of the central template (44) and is by sliding along said inclined terminal edge (440) displaced to each belonging inclined template section (460, 470) and upon that via corresponding rounded transition (461, 471) to the belonging arresting section (462, 472), and is also displaceable in opposite direction and in reciprocal sequence, whenever the movable part (32) of the guiding assembly (3) of the supporting unit (1) on a crane (9) is retracted from the stationary part (31) thereof in the opposite direction.

2. Supporting unit (1) according to Claim 1, **characterized in that** at least one of said continuous template sections (460, 470) is straight.

3. Supporting unit (1) according to Claim 1 or 2, **characterized in that** at least one of said continuous template sections (460, 470) is convex, namely deflected outwardly in a direction towards said terminal edge (440) of the template (44).

4. Supporting unit (1) according to anyone of Claims 1 - 3, **characterized in that** at least one of said continuous template sections (460, 470) is concave, namely deflected inwardly in a direction towards the stationary part (31) of the guiding assembly, namely away from said terminal edge (440) of the template (44).

5. Supporting unit (1) according to anyone of Claims 1-4, **characterized in that** said template (44) is attached onto said template unit (40) by means of screws (45, 45").

6. Supporting unit (1) according to Claim 5, **characterized in that** said template unit (40) is formed on a beam (41), which is firmly, but generally in a detachable manner, connectable with said stationary part (31) of the guiding assembly (3) of the supporting unit (1) of the crane (9).

7. Supporting unit (1) according to anyone of Claims 1-6, **characterized in that** said probe (55) is conceived as a rigid cylindrical protrusion (55'), which extends along its geometric axis (50) aligned with longitudinal geometric axis of the supporting leg (2), and which is firmly connected with the bearing member (51), which is by means of screws (511, 512) firmly, but detachably, attached to said bush (22) on the supporting leg (2).

8. Supporting unit (1) according to anyone of Claims 1 - 7, **characterized in that** said probe (55) is conceived as a rigid cylindrical protrusion (55'), which extends along its geometric axis (50) aligned with longitudinal geometric axis of the supporting leg (2), and which is furnished with an around said protrusion (55') freely rotatable rolling member (550), wherein said probe (55) as such is firmly connected with the bearing member (51), which is by means of screws (511, 512) firmly, but detachably, attached to said bush (22) on the supporting leg (2).

9. Supporting unit (1) according to anyone of Claims 1 - 8, **characterized in that** it comprises a single guiding assembly (3) with a supporting leg (2), which is pivotal around the longitudinal geometric axis (10) of the supporting unit (1).

10. Supporting unit (1) according to anyone of Claims 1 - 8, **characterized in that** it comprises two guiding assemblies (3), which are arranged substantially in a direction of the longitudinal geometric axis (10) of the supporting unit (1) and are oriented in opposite directions apart from each other, wherein each of them is furnished with a supporting leg (2), which is pivotal around the longitudinal geometric axis (10) of the supporting unit (1), and wherein both guiding assemblies (3) are arranged in the same horizontal plane.

11. Supporting unit (1) according to Claim 10, **characterized in that** both apart from each other protruding guiding assemblies (3) each per se extend in a direction along the longitudinal geometric axis (10) of the supporting unit (1) and are arranged coaxially with each other.

12. Supporting unit (1) according to Claim 10, **characterized in that** both apart from each other protruding guiding assemblies (3) each per se extend in a direction along the longitudinal geometric axis (10) of the supporting unit (1), but are arranged adjacent to each other in the same horizontal plane, and extend in parallel to each other.

13. A mobile hydraulic crane (9), comprising a crane base (91), a column (92), which is rotatably around a vertical geometric axis (901) embedded on said crane base (91), a primary arm (93), which is with its first terminal portion pivotally around the horizontal

geometric axis (902) attached to the free terminal portion of said column (92), a secondary arm (94), which is with its first terminal portion pivotally around the horizontal geometric axis (903) attached to the second terminal portion of said primary arm (93), as well as a grabber (95), which is pivotally around the horizontal geometric axis (905) and, when required, also rotatably around the vertical geometric axis (904), attached to the second terminal portion of said secondary arm (94), wherein said primary arm (93) is supported by a hydraulic cylinder (923), which is pivotally attached on the one hand to said column (92) and on the other hand to said primary arm (93), and wherein said secondary arm (94) is supported by a hydraulic cylinder (934), which is pivotally attached on the one hand to said primary arm (93) and on the other hand to said secondary arm (94), wherein said hydraulic cylinders (323, 924) are hydraulically connectable to the hydraulic circuit of the crane (9), and wherein the crane (9) further comprises at least one supporting unit (1), which is, like said crane base (9), adjusted to be mounted onto a vehicle chassis, and which on the crane is either in the area of suitable connecting points (101', 101") firmly connectable with said crane base (91), or is conceived as an integral part of said crane base (91) on the crane (9), **characterized in that** such crane (9) comprises at least one supporting unit (1) having all features according to anyone of Claims 1 - 12.

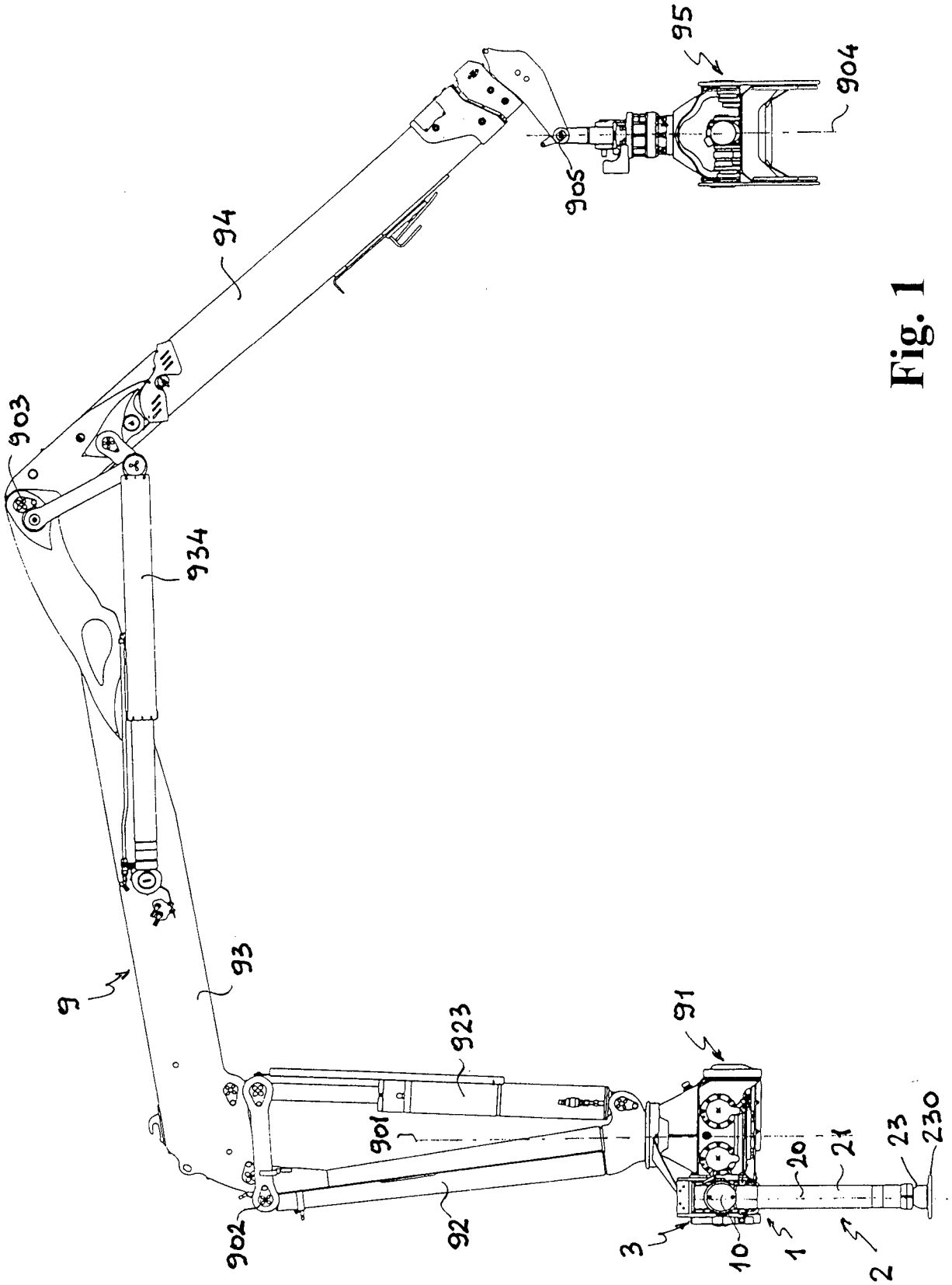

Fig. 1

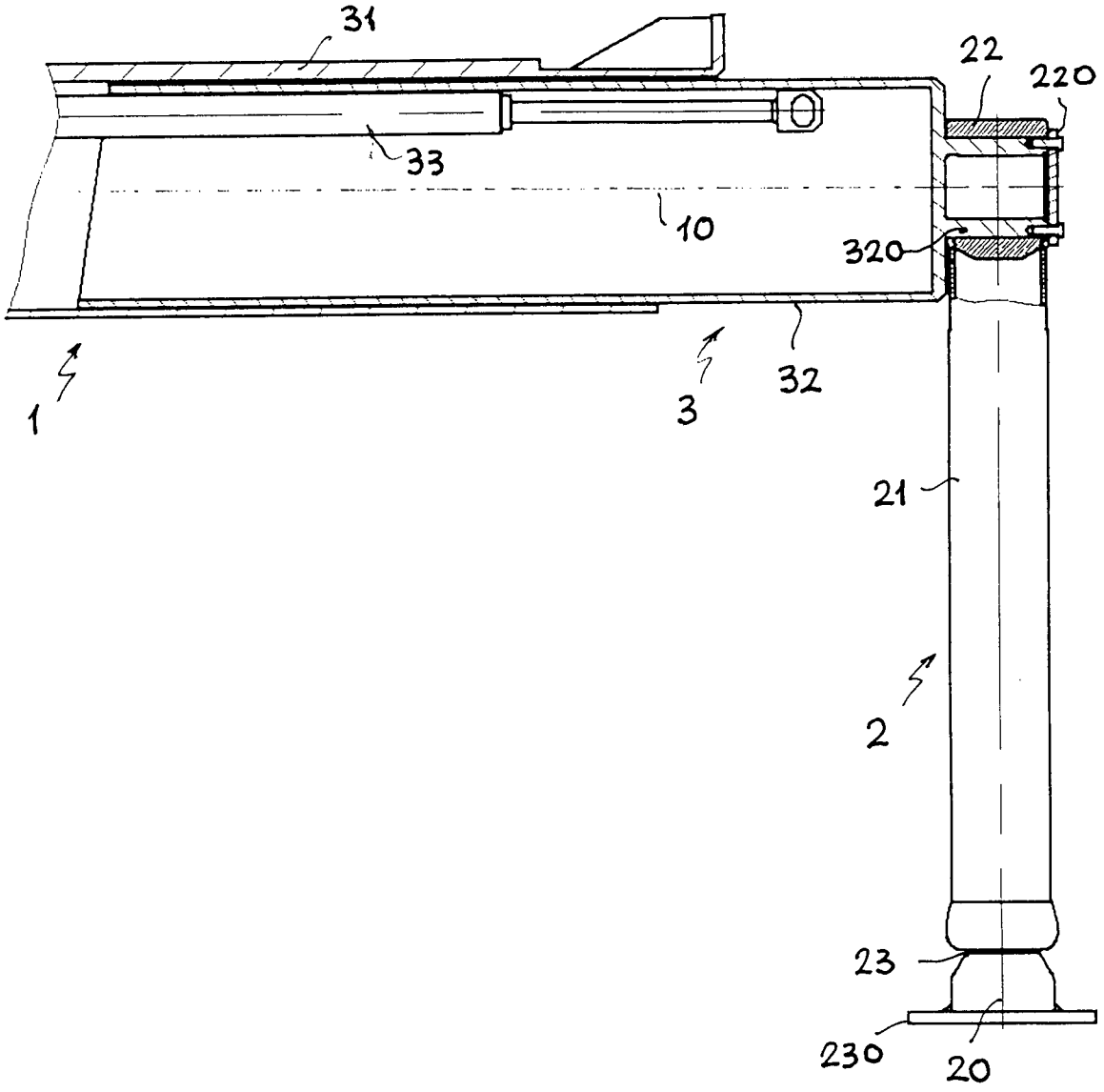

Fig. 2

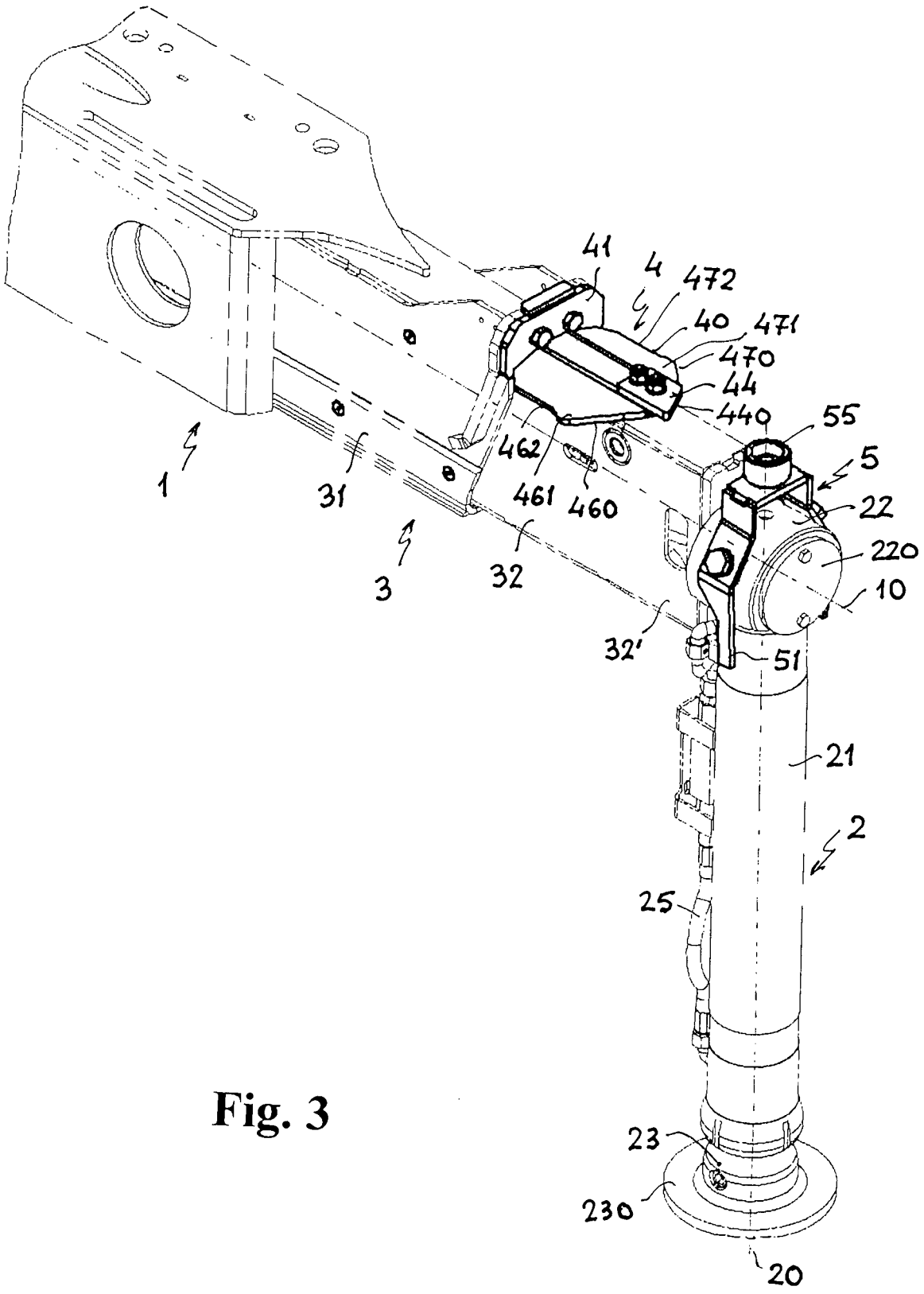
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Fig. 3

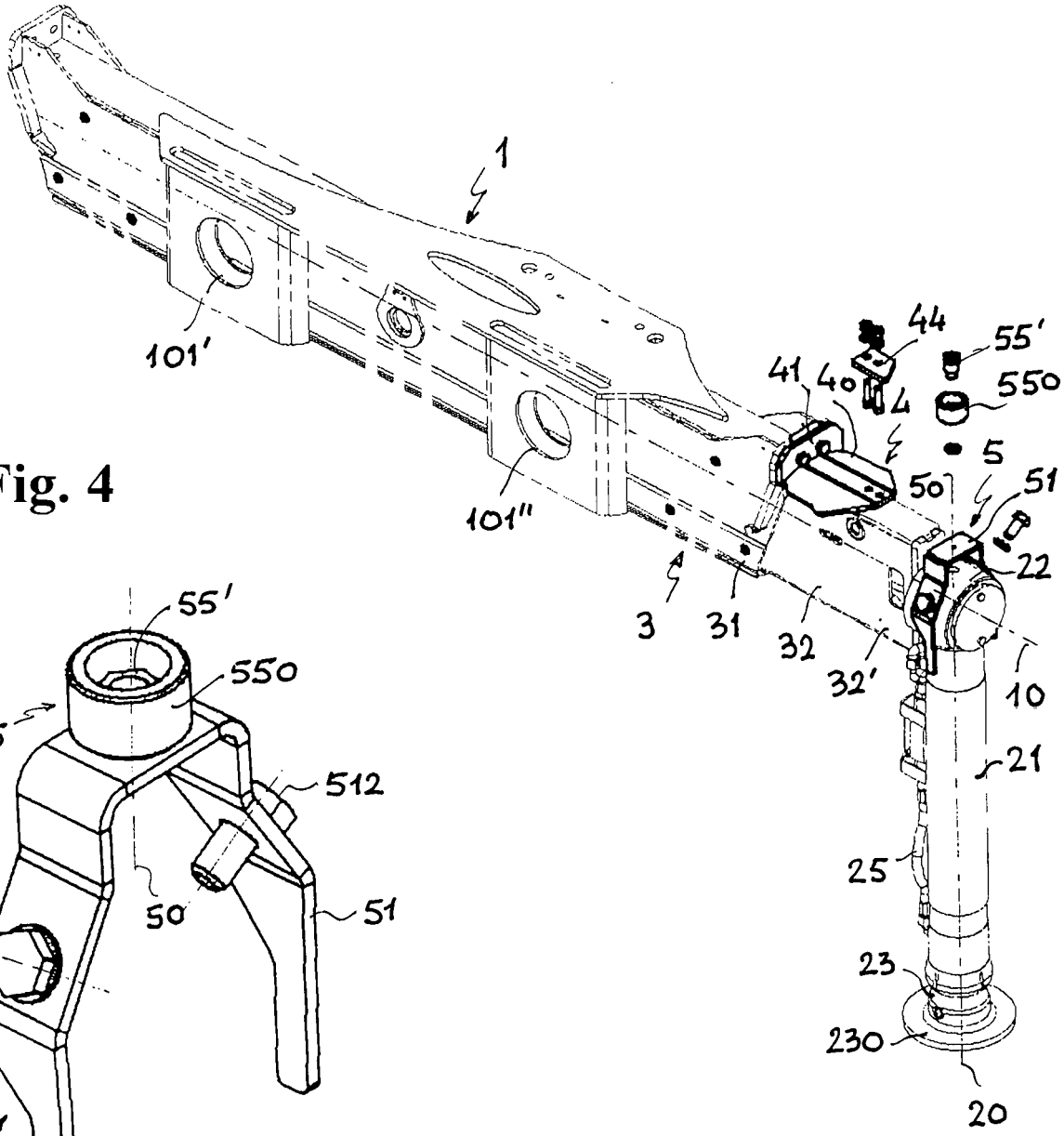

Fig. 4

Fig. 5

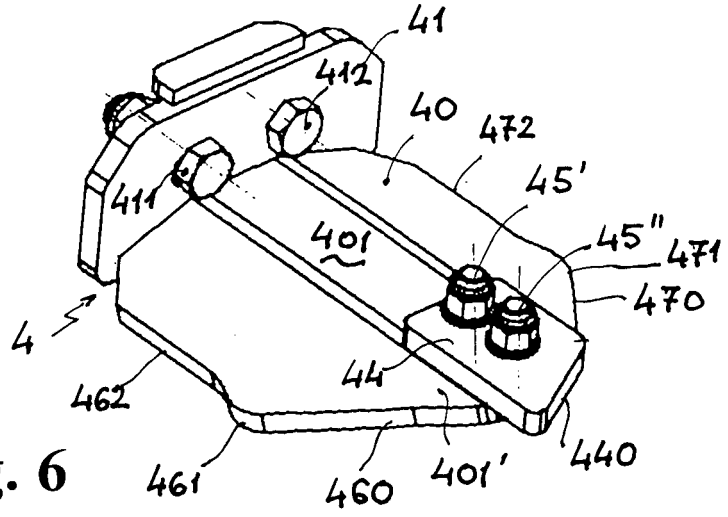

Fig. 6

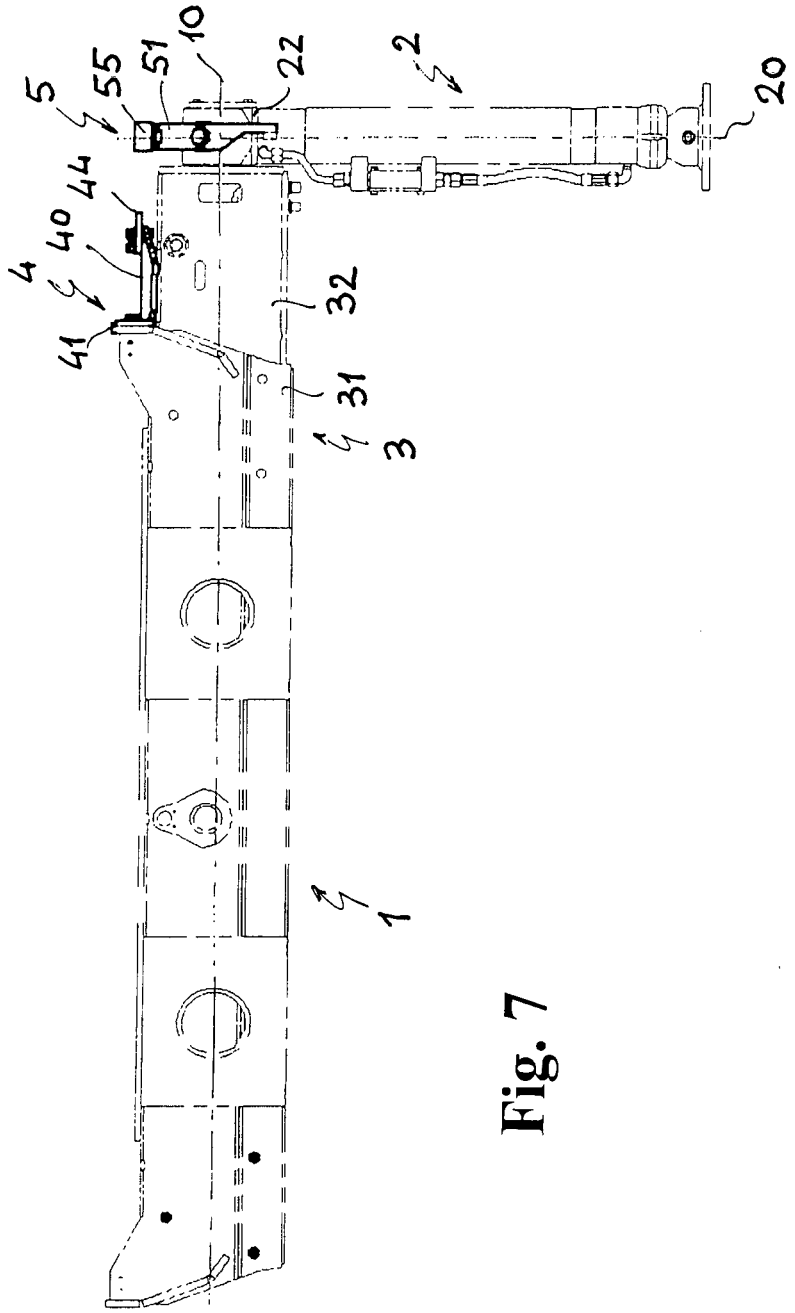

Fig. 7

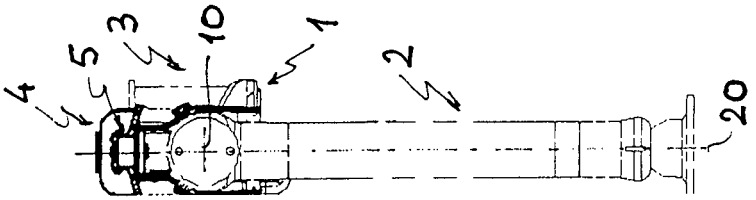

Fig. 8

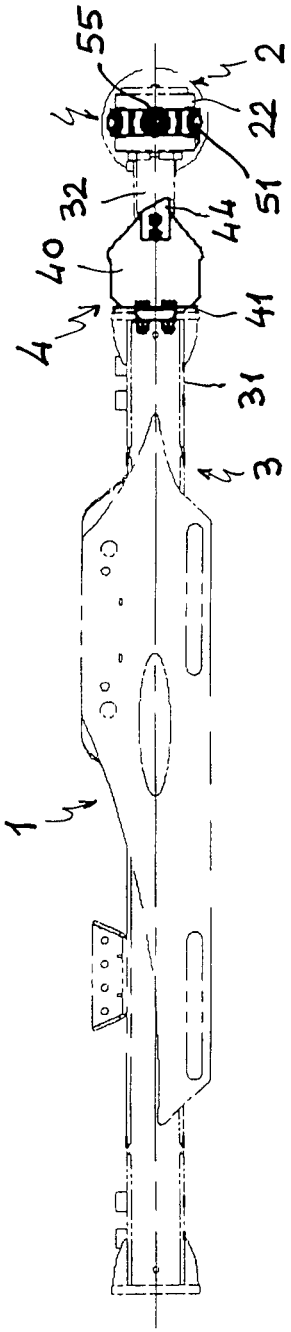

Fig. 9

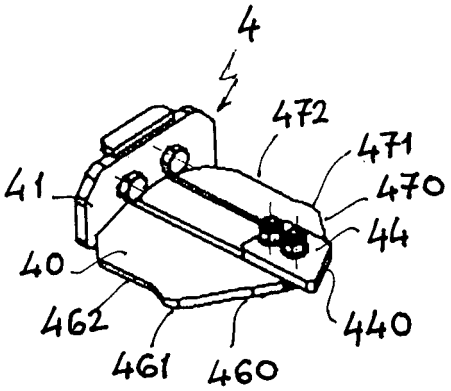

Fig. 10

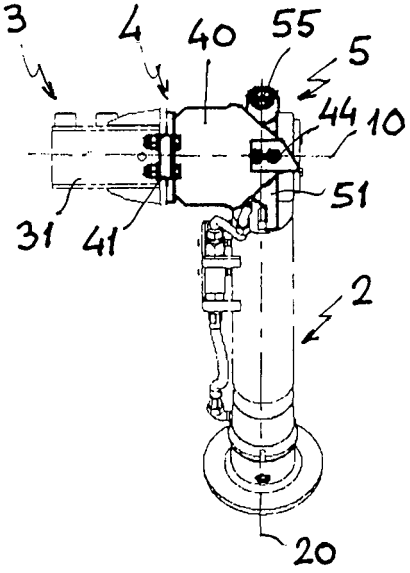

Fig. 11

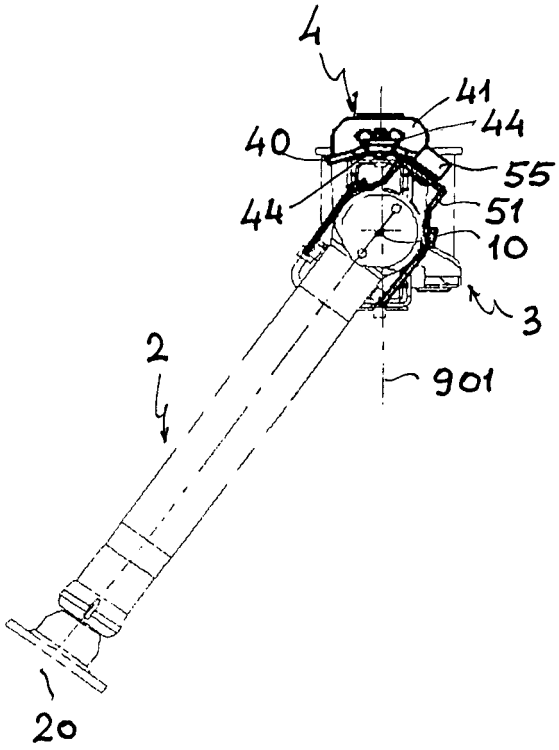

Fig. 12

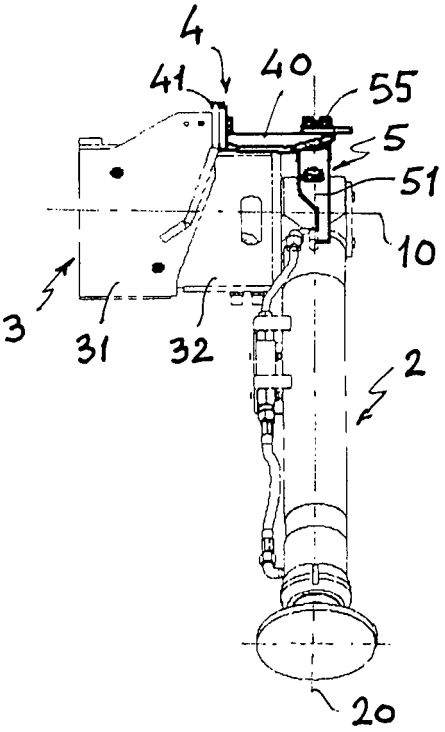

Fig. 13

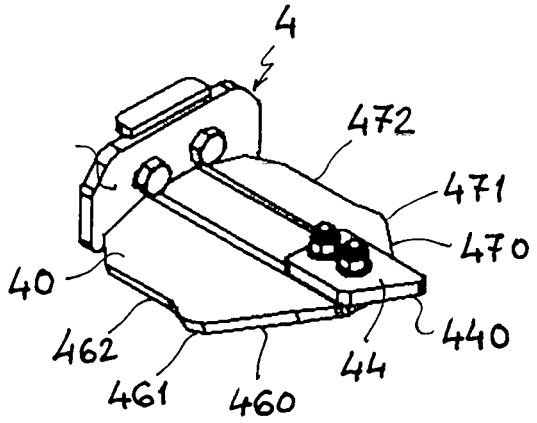

Fig. 14

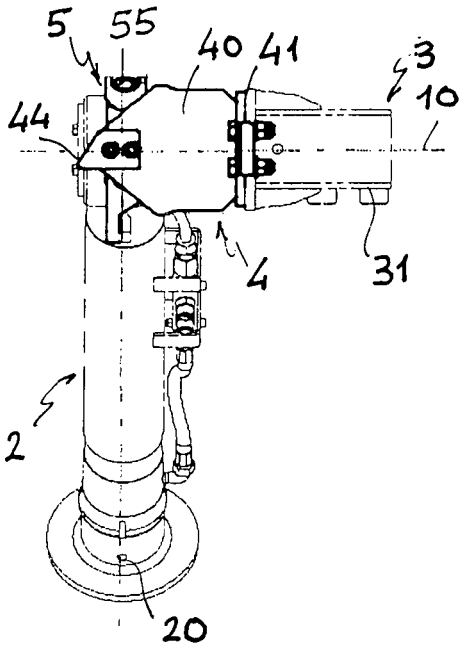

Fig. 15

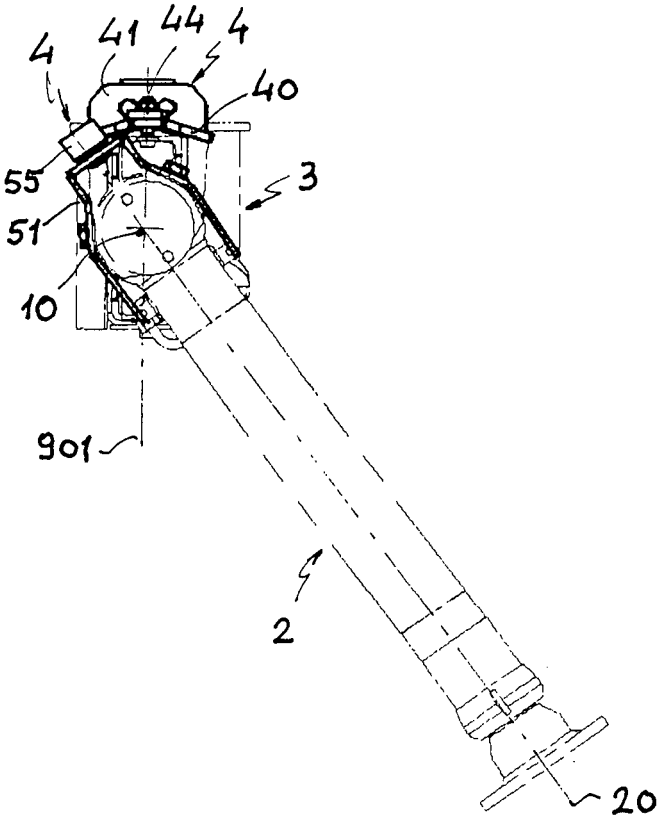

Fig. 16

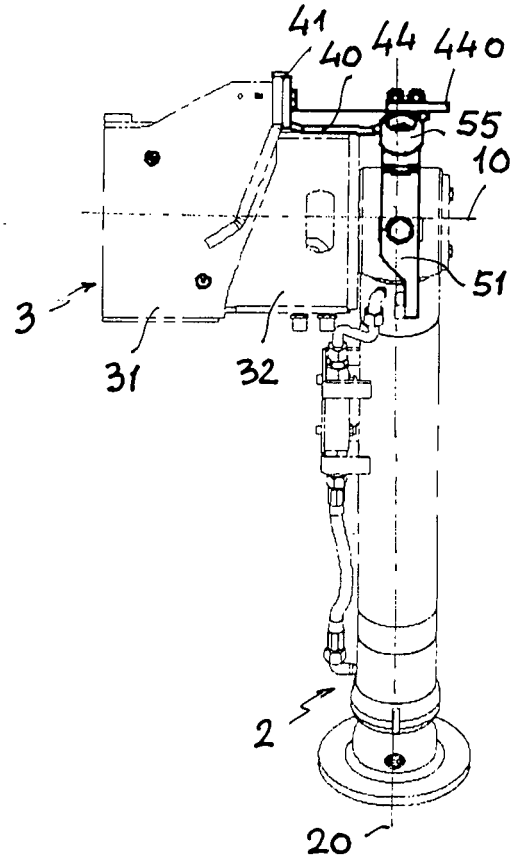

Fig. 17

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EUROPEAN SEARCH REPORT

Application Number
EP 24 00 0123

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	EP 1 586 528 B1 (LIV HIDRAVLIKA D O O POSTOJNA [SI]) 31 December 2008 (2008-12-31) * abstract * * figures *	1-13	
A	CN 112 919 343 B (SANY PALFINGER SPECIAL VEHICLE CO LTD) 30 September 2022 (2022-09-30) * abstract * * figures *	1-13	TECHNICAL FIELDS SEARCHED (IPC) B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 March 2025	Colletti, Roberta

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 00 0123

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

REFERENCES CITED IN THE DESCRIPTION

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