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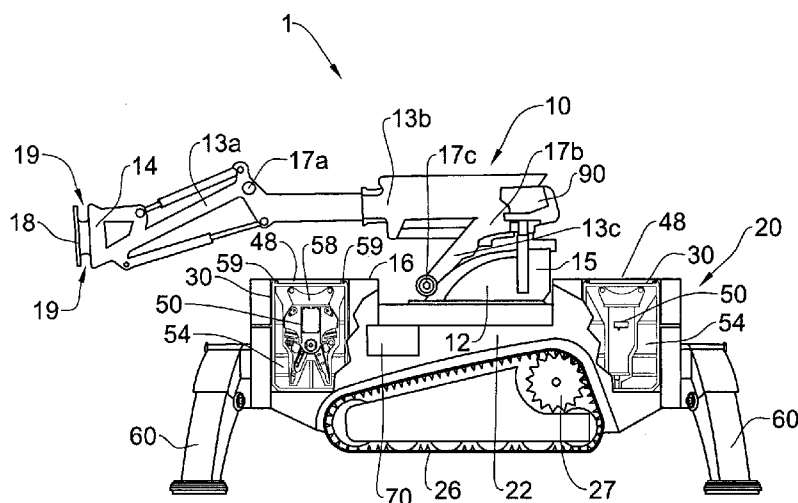


FIG. 1A

(57) Abstract: An operation platform (1), comprising: a platform base (20); a movement mechanism (26) connectable to said platform base and, when so connected, configured for displacement of the platform base; at least one operation tool zone (30) on said platform base configured for accommodating thereat at least one operation tool (50); and at least one boom assembly (10) having a first end fixable to said platform base (20), and a second free end (14), the boom assembly being controllable for displacing said second free end towards at least said one operation tool zone (30), coupling the second free end (14) to at least said one operation tool (50) accommodated within the operation tool zone (30), and maneuvering said second free end (14) with at least said one operation tool coupled thereto.

AN OPERATION PLATFORM

FIELD OF THE INVENTION

The presently disclosed subject matter relates to robotic vehicles. Specifically, the presently disclosed subject matter is concerned with operation platforms of unmanned ground vehicles.

BACKGROUND OF THE INVENTION

An unmanned ground vehicle can be a military robot used to augment soldiers' capabilities. This type of a robot is generally capable of operating outdoor and/or indoors and over a wide variety of terrain, functioning in place of humans. Unmanned robotics can be developed for both civilian and military use to perform dull, dangerous or the like activities.

One example of an unmanned ground vehicle known in the art is a teleoperated vehicle that is controlled by a human operator at a remote location via a communications link. All cognitive processes are provided by the operator based upon sensory feedback from either line-of-sight visual observation or remote sensory input such as video cameras. The unmanned vehicle can be controlled at a distance via a wireless connection while the user provides all control based upon observed performance of the vehicle. There is a wide variety of such teleoperated unmanned ground vehicles in use today. Predominantly these vehicles are used to replace humans in hazardous situations such as: rescue tasks in catastrophic situations (e.g., natural disasters such as earthquakes), military, combat tasks in urban zones, and emergency rescue missions, e.g. during terror attacks.

SUMMARY OF THE INVENTION

The presently disclosed subject matter, in its one aspect, provides an operation platform, comprising: a platform base; a movement mechanism connectable to said platform base and, when so connected, configured for displacing the platform base; at

least one operation tool zone on said platform base configured for accommodating therewithin at least one operation tool; and at least one boom assembly having a first end fixable to said platform base, and a second free end, the boom being controllable for displacing said second free end towards at least said one operation tool zone, coupling the second free end to at least said one operation tool accommodated within the operation tool zone, and maneuvering said second free end with at least said one operation tool coupled thereto.

The above operation platform can constitute or be a part of an unmanned ground vehicle, for example, such vehicle that is configured for demolition and breaching in urban fighting zones, for performing emergency search and rescue tasks, for treating hazardous materials that are dangerous for people (e.g., lifting the material, and digging in order to bury the material in the ground).

The operation platform can be remotely controllable by an operator (e.g., a soldier or a rescue team operator), in order to reduce the risk for his life in hazardous locations (e.g., urban fighting zones, collapsed buildings).

The operation platform can have a plurality of operation tool zones each configured for accommodating therein at least one operation tool, or it can have one operation tool zone configured for accommodating therein a plurality of operation tools. In any case, the operation platform can be configured for operating the plurality of operation tools to perform therewith a corresponding plurality of operations (each operation tool can be designated for performing a specific operation) and, particularly, for automatically changing the operation tools between the operations (as part of a specific activity), all by using the boom assembly. The change of the operation tools can be performed on-site, namely without the need to take to an operation tool from another location. The operation platform can be configured for choosing and switching operation tools according to different needs during one activity performed by the operation platform.

The operations and/or the activities that can be performed by the operation tools are, for example, compound breaching, demolition of concrete walls, sawing and cutting steel beams, and the like. Each operation tool can be designated for performing a specific operation, and a plurality of operation tools can be designated for performing a specific activity.

The operation platform can be pre-programmed to perform a plurality of activities, each of which requires a specific sub-array of operation tools, each configured to perform a specific operation.

The operation tools can be stored on the operation platform itself (and/or on a tool-carrier connected thereto). Alternatively, the operation tools can be stored at an external facility and can be automatically selected and the operation platform can be configured for controlling the boom assembly to transfer therefrom to the operation tool zone(s) those operation tools that are needed for a specific activity to be performed.

At least one of the operation tools can be provided with a corresponding compartment positionable, e.g. automatically positionable, at least at said one operation tool zone on the platform base, either together with the operation tool or prior to the disposition of the operation tool therein.

Alternatively, the compartment can be integrally mounted to the platform base or formed therein at least at said one operation tool zone, and the compartment being configured for receiving therein its corresponding operation tool.

In any of the above cases, the compartment can be configured to fit in shape and size to its corresponding operation tool, so as to firmly secure the latter in place.

The boom assembly can comprise a connection mechanism or a coupler configured for interconnecting said second free end to a corresponding coupling member of at least said one operation tool or to a corresponding holding member of at least said one compartment.

The connection mechanism between the boom assembly's second free end and at least said one operation tool or at least said one compartment can be selected from the group consisting of: mechanical mechanism, magnetic mechanism, electrical mechanism, and any combination thereof.

The operation platform can further comprise at least one outrigger configured for taking at least two states: a first transporting state in which said at least one outrigger can be elevated so as to allow movement of said platform base, and a second operating state in which said at least one outrigger can stabilize said platform base, preventing movement thereof.

The operation platform can further comprise at least one controlling unit configured to control the functioning of the operation platform by performing at least one of the following: controlling the displacement of said platform base by operating

said movement mechanism; selecting a sub-array of operation tools from an array of operation tools; accommodating the operation tools of said sub-array of operation tools to their corresponding operation tool zones; selecting at least said one operation tool from said sub-array of operation tools; coupling the boom assembly's second free end to at least said one selected operation tool so as to allow said maneuvering; maneuvering said second free end with at least said one operation tool mounted thereon; optionally, returning the operation tool back to the platform base and, again optionally, replacing it with another operation tool.

The controlling unit can further be configured for controlling the functioning of the operation platform by at least one of the following: defining a plurality of activities which the operation platform needs to perform and associating each of the activities with one or more operation tools (a sub-array of operation tools) selected from an array of operation tools; selecting a predetermined activity from said plurality of activities; and registering its corresponding operation tool when accommodated within its corresponding operation tool zone.

The controlling unit can be connected to an input unit which is adapted to receive instructions from an operator, for controlling the functioning of the operation platform. The communication between said input unit and said controlling unit can be wireless or wired. The controlling unit can further be configured for performing at least one of the following: identifying the location of the corresponding operation tool zone of the selected at least said one operation tool; displacing said boom assembly's second free end towards the corresponding operation tool zone of a selected operation tool; locking said second free end to the selected operation tool; taking out the selected operation tool from its corresponding operation tool zone; directing said second free end with the selected operation tool mounted thereon towards a predetermined operational direction; receiving feedback from at least one external sensor regarding said operation, electrically operating the operation tool by delivering electrical signals to the operation tool during operation; returning the operation tool to its corresponding operation tool zone; de-coupling the boom assembly's second free end from the operation tool; selecting another operation tool; displacing the boom assembly's second free end towards the corresponding operation tool zone of the another operation tool; coupling the another operation tool onto the second free end; and, locking the second free end to the another operation tool.

The operation tool can be selected from the group consisting of: hydraulic hammer, power crushing jaws, pinch cutter, steel cutting scissors, concrete crushers, power crushing jaws incorporated with scissors, grapples, clamps for lifting objects, steel shears, hydraulic cutting disc, digging bucket, bores driller, mine clearing tool, and any combination thereof.

The at least said one operation tool zone can be configured for receiving therein its corresponding operation tool/s so as to prevent their being visually exposed to the environment.

The platform base can have a side portion configured to incorporate at least said one operation tool zone in their horizontal position.

According to another aspect of the presently disclosed subject matter there is provided the an operation platform system, comprising: a platform base; a movement mechanism connectable to said platform base and, when so connected, configured for displacement of the platform base; an array of operation tools having at least one operation tool; at least one operation tool zone on said platform base configured for accommodating thereat at least said one operation tool; and at least one boom assembly having a first end fixable to said platform base, and a second free end, the boom assembly being controllable for displacing said second free end towards one of said operation tool zones, coupling the second free end to at least said one operation tool accommodated within the operation tool zone, and maneuvering said second free end with at least said one operation tool coupled thereto.

According to a still further aspect of the presently disclosed subject matter, there is provided a method for operating an operation platform, comprising:

providing an operation platform, comprising: a platform base; a movement mechanism connectable to said platform base and, when so connected, configured for displacement of the platform base; at least one operation tool zone on said platform base configured for accommodating thereat at least one operation tool; and at least one boom assembly having a first end fixable to said platform base, and a second free end;

displacing said second free end of said boom assembly towards at least said one operation tool zone;

coupling the second free end to at least said one operation tool accommodated within the operation tool zone; and,

maneuvering said second free end with at least said one operation tool coupled thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it can be carried out in practice, non-limiting examples will now be described with reference to the accompanying drawings, in which:

Figs. 1A and 1B illustrate a side and a rear view, respectively, of an operation platform according to one example of the presently disclosed subject matter when the outriggers of the operation platform are in an operational state. The operation tool zones that are shown in these figures, are presented with an exploded view for purposes of illustration;

Figs. 2A and 2B illustrate a side and a rear view, respectively, of an operation platform according to one example of the presently disclosed subject matter, when the outriggers of the operation platform are in a transporting state;

Figs. 3A and 3B illustrate a side view of operation platform according to one example of the presently disclosed subject matter. These figures illustrate the process of selecting and coupling an operation tool. The operation tool zones that are shown in these figures, are presented with an exploded view for purposes of illustration;

Fig. 4 illustrates a side view of an operation platform according to another example of the presently disclosed subject matter, in which the operation tools are horizontally positioned when accommodated within the operation platform. The operation tool zones that are shown in these figures, are presented with an exploded view for purposes of illustration;

Fig. 5A illustrates a side view of one example of an operation platform with a tool-carrier platform connected thereto;

Fig. 5B illustrates an upper view of a tool-carrier platform, according to one example;

Figs. 6A-C illustrate a front, a side, and an upper view, respectively, of a compartment according to one example of the presently disclosed subject matter;

Figs. 7A-C illustrate a front, a side, and an upper view, respectively, of a compartment according to another example of the presently disclosed subject matter;

Fig. 8 schematically illustrates a structure of a controlling unit, according to one example of the presently disclosed subject matter;

Fig. 9 schematically illustrates a table stored within of a controlling unit, according to one example of the presently disclosed subject matter;

Fig. 10 schematically illustrates a table stored within of a controlling unit, according to another example of the presently disclosed subject matter;

Fig. 11 schematically illustrates a table stored within of a controlling unit, according to another example of the presently disclosed subject matter; and,

Fig. 12 schematically illustrates a process according to which an operation tool is selected, according to one example of the presently disclosed subject matter;

DETAILED DESCRIPTION OF EMBODIMENTS

Attention is first directed to **Figs. 1A-B** which illustrate one example of a side view and a rear view, respectively, of an operational platform 1, according to the presently disclosed subject matter. As generally shown in **Fig. 1A**, operational platform 1 comprises a platform base 20 having a platform base body 22. The platform base body 22 is connected to a movement mechanism 26 (e.g., undercarriage tracks, wheels) which is configured for displacement of the operation platform 1. The movement mechanism 26 can be driven by a power unit (e.g., an engine). The platform base body 22 has a plurality of operation tool zones 30 (e.g., cavities, openings, spaces, sockets, cages, carriers) with openings 48 which are located on an upper portion 16 of the platform base body 22. Each of the operation tool zones 30 is configured for accommodating therein an operation tool, generally indicated as 50. Each operation tool 50 can be designated for performing a specific operation, and a plurality of operation tools 50 can be designated for performing a specific activity. The operation tool zones 30 that are shown in **Figs. 1A-B**, are presented with an exploded view for purposes of illustration.

The operational platform 1 additionally comprises a boom assembly 10 having three multiple arm segments 13a, 13b, and 13c. The arm segments 13a is pivotally connected to the arm segment 13b by a pivot 17a, and the arm segment 13b is pivotally connected to the arm segment 13c by a pivot 17b. The arm segment 13c of boom assembly 10 is also pivotally connected to a slewing upper structure 15 via pivot 17c. The upper structure 15 has a first end 12 being fixed to the upper portion 16 of the

platform base body **22**, and the arm segment **13a** has a second free end **14** configured for being spatially maneuvered for various tasks which the operation platform **1** is intended to perform. The upper structure **15** is configured for turning on a slewing ring bearing which allows the boom assembly **10** to rotate horizontally in full circle (360°) with relation to the platform base body **22**. The boom assembly **10** can have a hydraulic mechanism for manipulating the second free end **14** by moving of the arm segments **13a**, **13b**, and **13c** with respect to each other. The boom assembly **10** can perform the manipulation of the second free end **14** in combination with the rotation of the upper structure **15**, so as to allow the second free end **14** to be located in any spatial location in the 3-dinetal space within the limits of the dimensions of the boom assembly **10**.

Each operation tool **50**, can be provided with a corresponding compartment (e.g., a box, a container, section, storage structure), generally indicated as **54**, each of which is mountable within one of the operation tool zones **30**. According to the example of **Figs. 1A-B**, each compartment **54** is configured for receiving therein its corresponding operation tool **50** in a vertical position. **Fig. 1A** illustrates a side view of the operation tools **50** with their corresponding compartments **54** accommodated within the operation tool zone **30**, and **Fig. 1B** illustrates of rear view of the operation platform **1** with the operation tool **50** accommodated therein. The compartment **54** can be inserted into and pulled out of the operation tool zone **30** by the boom assembly **10** (or by any other means). Each compartment **54** can also be replaced with a different compartment **54** having a different operation tool therein (of the same or of a different type). According to other examples, the compartments **54** can be provided as an integral part of the operation tool zone **30**, being fixed to their corresponding operation tool zones **30**. In **Fig. 1A** illustrated two different compartments **54** (a compartment **54a** shown in **Figs. 6A-C**, and a compartment **54b** shown in **Figs. 7A-C**), each of which is configured to receive therein a different operation tool **50** (a pinch cutter **50a** shown in **Figs. 6A-C**, and a hydraulic hammer **50b** shown in **Figs. 7A-C**).

As it is clearly shown in **Figs. 1A-B**, the operation tool zone **30** is configured for receiving therein its corresponding operation tool **50** so as to prevent visually exposed thereof to the environment. Namely, when accommodated within the operation tool zone **30**, the operation tool **50** is hiddenly disposed therein, so that its type and its structure are now seen from the exterior of the operation platform **1**. This can be

important in a case in which the operator(s) of the operation structure would like to conceal the operation tools which are accommodated within the operation platform 1.

Attention is now made to **Figs. 6A-C**, which illustrate a front, a side, and an upper view of a compartment **54a** in a detailed manner, respectively. According to these figures, the compartment **54a** has an outer wall **51a** and an inner wall **52a**. The outer wall **51a** can have a shape and size which is configured to fit the shape and size of each one of the operation tool zones **30**. The outer wall **51a** can be favorably shaped in a way which allows its installment in a matching cavity within the operation tool zone **30** of the operation platform **1**. For example, the outer wall **51a** can have a box like shape outline which allows to slide it into a matching cavity in the operation platform, without any need to apply any access force beyond the compartment's self weight (with or without an operation tool inside). The compartment **54a** has low corners **57a** which contribute to the easiness of sliding the compartment inwards and outwards of a matching cavity of the operation tool zone **30** of the operation platform **1**. The inner wall **52a** of the compartment **54a** can have a shape and a size which suit the shape and the size of an operation tool configured to be accommodated therein. According to **Figs. 6A-C**, the operation tool which is accommodated within the compartment **54a** is a pinch cutter **50a**, and the inner wall **52a** is shaped so as to incorporate and firmly secure the pinch cutter **50a** therein. The pinch cutter **50a** has a coupling member **58** which is constructed of two elongated elements **55** which are held by rigid structures **56**. The two elongated elements **55** of the coupling member **58** is configured for being coupled to a coupler **18** which is connected to the second end **14** of the boom assembly **10**. The coupling between the coupler **18** and the coupling member **58** is configured to be performed by insertion of the elongated elements **55** in their corresponding recesses **19** (shown in **Fig. 1A**). As clearly illustrated in **Figs. 6A-C**, the compartment **54a** has four holding members **59** which can be used for lifting and moving the compartment **54a** for example during its accommodation within one of the operation tool zones **30** on the platform base **20**.

Attention is now made to **Figs. 7A-C** which illustrates a front, a side, and an upper view of the compartment **54b** in a detailed manner, respectively. The compartment **54b** illustrated in these figures has an outer wall **51b** which has substantially the same dimensions and structure as outer wall **51a**, so as to fit the shape and size of each one of the operation tool zones **30**. An inner wall **52b** of compartment

54b can have a shape and a size which fix the shape and the size of the operation tool configured to be incorporated therein. According to this example, the operation tool which is accommodated within the compartment **54b** is a hydraulic hammer **50b**, and the inner wall **52b** is shaped so as to incorporate and firmly secure the hydraulic hammer **50b** therein. The hydraulic hammer **50b** has a coupling member **58** which is constructed of two elongated elements **55** which are held by rigid structures **56**. The two elongated elements **55** of the coupling member **58** is configured for being coupled to a coupler **18** which is connected to the second end **14** of the boom assembly **10**. The coupling between the coupler **18** and the coupling member **58** is configured to be performed by insertion of the elongated elements **55** in their corresponding recesses **19** (shown in **Fig. 1A**). As can be clearly seen in **Figs. 6A-C** and **Figs. 7A-C**, the outer walls **51a** and **51b** have substantially identical shape and size, and the inner walls **52a** and **52b** are shaped differently due to the different structures of the pinch cutter **50a** and the hydraulic hammer **50b** which are configured to be received therein.

Referring back to **Figs. 1A-B**, the operation tools **50** can be firmly coupled to the compartment **54**, thereby substantially fixed in place with respect to the operation platform body **22**. The operation tool **50** can be firmly coupled to the compartment **54** as long as such a fixed or constant position of the operation tool **50** therein is required. Therefore, forces exerted on the operation tool **50** while it is coupled to the compartment **50**, such as forces resulting for example from a sudden acceleration or deceleration of the operation platform, would not affect the operation tool's position with respect to the operation platform body **22**. According to certain examples, the firm holding (or gripping) of the operation tool **50** in place can be achieved by an electro-mechanical lock device which is unlocked when the operation tool **50** is detached from the compartment **54** via boom assembly **10**. According to certain embodiments of the present invention, the operation tool **50** is constructed in such a way that its own weight forces it to be in the right fixed position, and only when it is pulled in a certain direction (e.g. by the arm of the boom assembly) it can be released from its corresponding compartment **54**.

The operation platform **1** has four outriggers **60** (two frontal outriggers and two back outriggers) configured for taking two states: a first transporting state (as shown in **Figs. 2A-B** and in **Fig. 5A**) in which the outriggers **60** are elevated so as to allow movement of the platform base **20** from place to place according to different needs, and

a second operating state (shown in **Figs. 1A-B**) in which the outriggers **60** are stabilizing the platform base **20** with respect to the ground and preventing its movement during operation.

As mentioned above, the second free end **14** has a coupler **18** which is configured for connecting the second free end **14** to a corresponding coupling member **58** of the operation tool **50**. The coupler **18** can also be configured for connecting second free end **14** to the corresponding holding member **59** of the compartment **54**. According to one example, the connection between the coupler **18** and the holding members **59** can be provided with an additional connector (not shown) configured for interconnecting therebetween. According to another example, the connection between the coupler **18** and the holding members **59** can be provided by changing the length of the coupler **18** and fitting it to the distance between at least two holding members **59**.

The platform base **20** of **Figs. 1A** and **1B** is configured to receive and carry at the same time four different (or the same) operation tools **50**, each accommodated within a corresponding compartment **54** which is configured to be received at its corresponding operation tool zone **30**. These four operation tools **50** are defined for the purposes of the presently disclosed subject matter as a sub-array of operation tools **50'**. The minimal number of operation tools **50** which can be incorporated in the sub-array of operation tools **50'** can be one, and their maximal number equals to the number of the operation tool zones **30** on platform base **20**. The sub-array of operation tools **50'** can be selected from an array of operation tools **51** (for example, shown in **Fig. 5B**). The array of operation tools **51** can comprise any number of operation tools **50** which can be stored at an external location which can be, for example, a tool-carrier (shown in **Figs. 5A-B**), a storage room, a warehouse, or any other conventional location in which operation tools can be stored. These operation tools can be stored with their corresponding compartments. The number of operation tools **50** in a sub-array of operation tools **50'** is always less than (or equal to) the number of operating tools **50** of any array of operation tools **51** from which the sub-array **50'** has been chosen. The operation platform **1** can be provided as a full operation platform system, when the operation platform **1** is provided with an array of operation tools **51** (with or without their corresponding compartments).

The operation tool **50** can also be any known in the art tool which can be mounted on and/or coupled to the second free end **14** of the boom assembly **10** in order

to perform a specific operation. According to different examples, the operation tool **50** which can be included in the array of operation tools **51**, can be at least any one of the following: hydraulic hammer, power crushing jaws, pinch cutter, steel cutting scissors, concrete crushers, power crushing jaws incorporated with scissors, grapples, clamps for lifting objects, steel shears, hydraulic cutting disc, digging bucket, bores driller, mine clearing tool. According to one of these examples, the hydraulic hammer can be used for an operation which is rock braking and concrete demolition, the digging bucket can be used for an operation which is loading and unloading loose material, the grapples can be used for an operation which is loading and shifting different objects, the steel shears can be used for an operation which is cutting steel bars and reinforced concrete, and the concrete crushers can be used for an operation which is demolition jobs.

The main operations which the operation platform **1** is configured to perform are the following: preparing itself for an activity by loading a plurality of operation tools **50** (the sub-array **50'** of operation tools selected from an array of operation tools **51**) thereon prior to an activity, displacing itself towards the location of the operation (e.g., a predetermined building, a predetermined object) by using movement mechanism **26**, selecting and coupling to the second free end **14** of the boom assembly **10** one of the operation tools **50** located within one of the operation tool zones **30**, and maneuvering the second free end **14** with the selected operation tool **50** mounted thereon in order to perform the operation which the selected operation tool **50** is designated to perform.

Attention is now made to **Figs. 3A-B**, which illustrate the operation platform **1** in a pre-operation position. The operation tool zones **30** that are shown in **Figs. 3A-B**, are presented with an exploded view for purposes of illustration. **Fig. 3A** illustrates the process of selecting an operation tool **50** (in this case the pinch cutter **50a** from **Figs. 6A-C**) located on the platform base **20** according to specific instructions received from a controlling unit **70** (e.g., according to instructions received from an operation) which is located within the operation platform **1**. Following these instructions, the second free end **14** is displaced towards the corresponding operation tool zone **30** and compartment **54**, the second free end **14** is inserted into the compartment **54** of the operation tool **50**, and the coupler **18** is coupled to the coupling member **58** of the operational tool **50**.

In **Fig. 3B**, illustrated second free end **14** with the operation tool **50** mounted thereon and ready for a specific operation which the operation **50** is designated to perform (which can be part of a general specific activity which the operation platform is

intended to perform). Following the completion of this operation, the second free end **14** with the operation tool **50** mounted thereon can be displaced towards its corresponding compartment **54**, and the coupler **18** can be automatically de-coupled from the coupling member **58** of the operation tool **50** after the position of the operation tool **50** within its corresponding compartment **54**.

Each compartment **54** and/or operation tool **50** can include means for its identity verification such as RF tag or barcode tag that can be sensed by a corresponding sensor installed on the operation platform **1**. This way, a mismatch between the identity of the compartment **54** and/or the operation tool **50**, as configured in controlling unit **70** and the actual identity as revealed by the physical RF tag or barcode tag, can be immediately recognized and reported for example to an operator of the operation platform **1**.

In **Fig. 4** illustrated another example of an operation platform **100**. According to this example, the operation platform **100** has the same technical features as operation platform **1**, and the difference between them is the position of the operation tools therein, and the structure of the front outriggers. The operation platform **100** has operation tool zones **130** which are configured to accommodate operation tools **150** with their corresponding compartments **154**. The operation tool zones **130** which are shown in **Fig. 4**, are presented with an exploded view for purposes of illustration. As can be clearly seen in this figure, the operation tools **150** are horizontally positioned within their corresponding compartments **154**. In order to connect the second free end **114** to one of the operation tools **150**, the second free end **114** can be displaced toward a frontal portion **166** or a back portion **167** of the operation platform **100**. The operation platform **100** is having one front bulldozer **161** which is used as an integrated stabilizer and two back outriggers **160**. The bulldozer **161** is configured to move along the direction of arrow **A** in order to be in one of the states: a transporting state (marked with a dotted line) and an operating state (marked with a solid line). The back outriggers **160** are configured to move in the same manner of the outrigger **60** which are shown in **Figs. 1A-B**.

Reference is now made to **Figs. 5A-B**, in which illustrated the operation platform **1** with a tool-carrier platform **80** connected thereto via a connecting mechanism **82**. In **Fig. 5A** illustrated a side view of the operation platform **1** with the tool-carrier platform **80**, and in **Fig. 5B** illustrated an upper view of the tool-carrier

platform 80. The tool-carrier platform 80 illustrated in these figures is configured for accommodating the array of operation tools 51 and/or the sub-array of operation tools 50' in their corresponding operation tool zones 31. Each of the operation tools of assembly 51 can be stored in its corresponding compartment 51, and the compartment can be accommodated within the operation tool zones 31. The tool-carrier platform 80 can have a displacement mechanism 84 which is configured for allowing displacement thereof. As shown in Fig. 5A, the outriggers 60 of the operation platform 1, are in their transporting state (similar to Figs. 2A-B). In this state, the operation platform 1 can be displaced from one location to another location with the tool-carrier platform 80 connected thereto. Prior to a specific pre-selected activity, the boom-assembly 10 can select specific compartments 54 with operation tools 50 located within operation tool zones 31, and displace the selected compartments to the corresponding operation tool zones 30 located on platform base 20. According to different examples, the tool-carrier platform 80 can be provided as an integral part the operation platform 1. In this case, the tool-carrier platform 80 can be used for accommodating the sub-array of operation tools 50' during an activity of the operation platform, and the boom assembly can use the operation tools 50 accommodate within the tool-carrier platform 80 for mounting one of them thereon, and using it during said activity.

In order to perform the different operations and/or activities, the operation platform 1 comprises the controlling unit 70 (mentioned above) configured to control the functioning of the operation platform 1. The controlling unit comprises a memory and a processor which can be programmed in order to perform different tasks. For example, the controlling unit 70 can control the displacement of the platform base 20 by operating the movement mechanism 26. This can be performed by instructing the movement mechanism 26 to rotate or to stop rotating wheel 27. The controlling unit 70 can be used in order to define a plurality of activities which the operation platform is able to perform (e.g., breaking a wall, treating explosives, moving objects from place to place, etc.) This can be performed by associating each of the activities with a predetermined sub-array of operation tools 50'. For example, in order to break a wall, the following two operation tools can be needed: a hydraulic cutting disc, and a hydraulic hammer, each of which is designated to perform a specific operation. These two operation tools assemble a sub-array of operation tools which are associated with the activity of breaking a wall. The definition of the activities can be performed by an

operator which instructs the controlling unit 70 for this task. The controlling unit 70 can be programmed for selecting the sub-array of operation tools 50' from an array of operation tools 51 and accommodating the operation tools 50 of the sub-array of operation tools 50' at their corresponding operation tool zones 30. This can be performed in a serial manner (one by one) by detecting each one of the operation tools 50 in the sub-array 50', coupling the second free end 14 to the compartment 54 of each operation tool 50, and displacing the second free end 14 with the compartment 54 coupled thereto towards the corresponding operation tool zone 30. Each compartment can be received within an available operation tool zone 30 at each time, and registered therein by the controlling unit 70. By doing this, the controlling unit 70 can control the accommodation of the operation tools 50 on the platform base 20. According to an alternative example, the operation tools 50 can be transferred to the platform base without their compartments 54. In this case, the second free end 14 can be coupled to the coupling member 58 of each operation tool 50, and afterwards the operation tool 50 will be displaced to its corresponding operation tool zone 30. According to this example, the operation tool zones 30 already include the compartments 54.

Following the placement of the operation tools 50 on operation platform 1, the controlling unit 70 can use the operation tools 50 for predetermined activities. This can be performed by controlling the selection an operation tool 50 from the sub-array of operation tools 50' accommodated in platform base 20. The selection of the operation tool 50 can be accompanied with identification of the location of the operation tool zone 30 of the selected operation tool 50, displacement of the second free end 14 towards the corresponding operation tool zone 30 of the selected operation tool 50, coupling of the second free end 14 to the selected operation tool 50 by locking of second free end 14 to the operation tool 50 (for example, by using coupler 18 and coupling member 58), and taking out the operation tool 50 from its corresponding operation tool zone 30, i.e., from the compartment in which the operation tool 50 is accommodated. The operation tool 50 can be coupled and/or de-coupled to and from the second free end 14 in an automatic manner. All these operations can be controlled by the controller 70. Following the extraction of the operation tool 50 from its compartment (or its operation tool zone), the operation tool can be used for performing its designated operation. For this purpose, the controlling unit 70 can control the maneuvering of the second free end 14 with the selected operation tool 50 mounted thereon. During the maneuvering, the controlling

unit **70** can also direct the second free end **14** with the operation tool **50** mounted thereon towards a predetermined operational direction (e.g., a wall that has to be broken by the operation tool), receive feedback from an external sensor (e.g., a camera **90**, IR vision systems) regarding the operation, and, electrically operate the operation tool **50** by delivering electrical signals to the operation tool **50** during the operation (in a case in which the operation tool **50** is having an ability to perform electrically operated tasks such as cutting, rotating, moving, etc.). Additionally to all these tasks, the controlling unit **70** can also control the process of replacing the operation tool **50** coupled to second free end **14** with another operation tool. This can be performed by inserting the operation tool **50** coupled to the second free end **14** to its corresponding operation tool zone **30**, de-coupling the second free end **14** from the operation tool **50**, selecting another operation tool, displacing the second free end **14** towards the corresponding operation tool zone of the another operation tool, coupling the another operation tool onto the second free end **14**, and locking the second free end tool-carrier platform **80** to the another operation tool. The controlling unit **70** is also configured for controlling the position of outriggers **60** by converting thereof from the first transporting state (Figs. **1A-B**) or the second operating state (Figs. **2A-B**).

The controlling unit **70** is connectable to an input unit (not shown) which is configured for receiving instructions from an operator, thereby controlling the functionality of the operation platform **1**. The communication between the controlling unit **70** and the input unit can be provided by a wireless receiver **75** located on the upper portion of the platform base **20**.

Reference is now made to **Fig. 8** in which illustrated an example of the controlling unit **70**, and some of its internal modules. The controlling unit **70** can be responsible for the automatic process in which a specific operation tool **50** is automatically coupled to the boom assembly **10**, and also for other operation which the controlling unit **70** can control. According to one example, during the automatic process in which a certain operation tool **50** is automatically coupled the boom assembly **10**, there is no requirement for any active physical intervention from an operator of the operation platform **1**. According to another example, the operator can fully control the operation of the operation tool mounted on the boom assembly in a manual or a semi-manual manner (e.g., via a joystick).

In **Fig.8** illustrated a schematic block diagram of the controlling unit **70** which comprises a CPU **210** configured for performing computerized functionalities which are performed by modules such as the following modules: a boom control module **225**, a platform control module **226**, a tool selection module **227**, and an operator interface module **228**. The boom control module **225** is configured to control the position of the boom assembly **10** in the three-dimensional space. This includes for example controlling the boom assembly's second free end **14** lift and tilt angles, and the turning of the upper structure **15**. The platform control module **226** is configured to track the type and the location of each operation tool **50** with its corresponding compartment **54** which are located on platform base **20**. The data of each compartment **54** can be stored for example on a memory unit **230** which is located within the controlling unit **70**. According to different examples of the presently disclosed subject matter, the memory unit **230** can store the following data: identity number of each operation tool, identity number of each operation tool zone, identity number of each boom assembly, weight of each operation tool, identification number of a corresponding compartment of each operation tool, spatial location of the operation tool on the platform base, identification number of a corresponding operation tool zone of each operation tool, number of total activation hours of each operation tool, number of maximal activation hours of each operation tool, type of each operation tool, the activities which said operation tool is configured to perform, the operation which said operation tool is configured to perform, present location of each operation tool, present location of the second free end of each boom assembly, maximum carrying capacity of each boom assembly, occupancy of each boom assembly, occupancy of each operation tool zone, the current operation tool coupled to the boom assembly, the current location of each compartment.

This data can be organized in a table such as the table shown in **Fig. 9**. Referring to **Fig. 9**, the data of each compartment **54** can include for example the unique identity number (column **310**) and the type of operation tool **311** (column **311**) which can be stored within the compartment. This data can also include for example data related to whether any operation tool **50** is presently stored therein (column **312**) and the operation tool's identification number (column **313**). This data can also include the relative location of the compartment with respect to a certain fixed location on board of the operation platform **1** (column **314**). This data can be specified for example by XYZ coordinates. The XYZ coordinates can specify for example a position which the boom

assembly should be moved to in order to couple or de-couple compartment and/or the operation tool incorporated therein. The location of the compartment **54** (column **314**) enables the controlling unit **70** to direct the second free end **14** accurately to the appropriate position for coupling or de-coupling of an operation tool from the specific compartment **54**, or in order to displace the compartment into a specific operation tool zone **30**.

The platform control module **226** can be configured to track all the available operation tools **50** which are on board of the operation platform **1** and each such tool's data. The data which is related to each operation tool **50** can be stored for example on the memory unit **230**. This data can be organized in a table such as the table shown in **Fig. 10**. Referring to **Fig. 10**, the table in this figure includes for example each operation tool's unique identity number (column **410**) and their location on board the operation platform **1** (column **411**) (I.e. either the identity of the respective compartment in which they are incorporated or otherwise the identity of the boom assembly to which the operation tool is coupled to. The operation tool's data can additionally include for example the number of work hours the operation tool has been actively used since the last service (column **412**). The operation tool's data can additionally include for example the weight of the operation tool (column **413**) and its type (column **414**).

According to an example in which more than one boom assembly is included within an operation platform (not shown) the platform control module **226** can also be configured to track each boom assembly, and its related data. This data can also be stored for example on memory unit **230**. The data can be organized in a table such as the table shown in **Fig. 11**. Referring to **Fig. 11**, the boom assembly's data includes for example each boom's assembly unique identity number (column **510**) and the location of its second free end **14** with respect to a certain fixed location on board the operation platform (column **511**). The data can be specified for example by XYZ coordinates. The boom assembly's data can additionally include for example the maximum carrying capacity (column **512**) and whether it is occupied or not (column **513**).

The controlling unit **70** can also comprise an operator interface module **230** which processes commands issued by an input unit of an operator and received by the communication unit **234** which can be connected, for example, to the wireless receiver **75**.

The controlling unit **70** can also comprise a tool selection module **227**. The tool selection module **227** is configured for responding to operation tool selection commands initiated for example remotely by an operator of the operation platform **1** and received at the operation platform by way for example of the wireless receiver **75** (e.g., RF receiver). The selection command can specify a type of an operation tool the operator would like to use. Once received, the selection command is processed by the tool selection module **227** as further illustrated with reference to **Fig. 12**, causing the controlling unit **70** to automatically couple the selected operation tool **50** to the boom assembly.

Reference is now made to **Fig. 12** which schematically illustrates an example of a flowchart for the operation of controlling unit **70**, detailing operations performed by the tool selection module **227** of **Fig. 8** in response to a selection command initiated by an operator of the operation platform **1** which is received at the operation platform **1**.

The process starts in with an event of a selection command received **811** at the operation platform **1** (e.g. by way of the wireless receiver **75**) and processed by the operator interface module **228** of **Fig. 8**. The selection command specifying one of the operation tools **50** that the operator wishes to use. The command's content is transferred by the operator interface module **228** to the tool selection module **227** of **Fig. 8** for further processing.

In operation **612** it is checked whether there is at least one operation tool on board the operation platform which corresponds to the tool type which was specified in the command. This can be checked, for example, by referring to the table of **Fig. 10** which is stored in the memory unit **230** of **Fig. 8**. In case no such operation tool exists on board the platform, an error message is sent to the operator in step **613**. Otherwise, it is checked at operation **615** whether there is more than one operation tool of the type specified by the operator. In case there are multiple operation tools of the same type. A specific operation tool is chosen for coupling at operation **614**. For example, the chosen operation tool may be the one with minimum work hours according to the table at **Fig. 10**. In operation **616** it is checked whether there is a non occupied boom assembly with a carrying capacity suitable for carrying the selected operation tool. If no such boom assembly exists it is decided at operation **617** which of the occupied boom assembly to decouple. In operation **619**, an instruction to couple the chosen boom assembly and the chosen operation tool is sent to the platform control module for execution. Returning to

Fig.8, the controlling unit **70** also can comprise an array of sensors **232** allowing it to sense the state of the operation platform **1** and collect information for example in relation to the data specified above with regard to **Figs. 9, 10, and 11**. For example, pressure sensors confirm the successful detachment of an operation tool from one of the compartments and a successful coupling of the operation tool to the boom assembly.

CLAIMS:

1. An operation platform, comprising:
 - a platform base;
 - a movement mechanism connectable to said platform base and, when so connected, configured for displacement of the platform base;
 - at least one operation tool zone on said platform base configured for accommodating thereat at least one operation tool; and
 - at least one boom assembly having a first end fixable to said platform base, and a second free end, the boom assembly being controllable for displacing said second free end towards at least said one operation tool zone, coupling the second free end to at least said one operation tool accommodated within the operation tool zone, and maneuvering said second free end with at least said one operation tool coupled thereto.
2. An operation platform according to Claim 1, wherein at least said one operation tool is provided with a corresponding compartment which is positionable at least at said one operation tool zone on the platform base.
3. An operation platform according to Claim 1, further comprising at least one compartment integrally mounted to said platform base or formed therein at least at said one operation tool zone, the compartment being configured for receiving therein its corresponding at least said one operation tool.
4. An operation platform according to any one of Claims 2 or 3, wherein said one operation tool is configured to fit in shape and size to its corresponding compartment, so as to firmly secure in place at least said one operation tool.
5. An operation platform according to any one of the preceding claims, wherein said boom assembly comprises a coupler or a connection mechanism configured for interconnecting said second free end to a corresponding coupling member of at least said one operation tool or to a corresponding holding member of at least said one compartment.
6. An operation platform according to any one of the preceding claims, wherein the connection mechanism between said second free end and at least said one operation tool or at least said one compartment is selected from the group consisting of: mechanical mechanism, magnetic mechanism, electrical mechanism, and any combination thereof.
7. An operation platform according to any one of the preceding claims, further comprising at least one outrigger configured for taking at least two states: a first

transporting state in which said at least one outrigger is elevated so as to allow movement of said platform base, and a second operating state in which said at least one outrigger is stabilizing said platform base and preventing movement thereof.

8. An operation platform according to any one of the preceding claims, further comprising at least one controlling unit configured to control the functioning of the operation platform by performing at least one of the following:

- controlling the displacement of said platform base by operating said movement mechanism;

- selecting a sub-array of operation tools from an array of operation tools;

- accommodating the operation tools of said sub-array of operation tools to their corresponding operation tool zones;

- selecting at least said one operation tool from said sub-array of operation tools;

- coupling said second free end of said boom assembly to at least said one selected operation tool onto said second free end;

- maneuvering said second free end with at least said one operation tool mounted thereon; and,

- replacing the operation tool coupled to said second free end with another operation tool.

9. An operation platform according to Claim 8, wherein said controlling unit further configured for controlling the functioning of the operation platform by at least one of the following: defining a plurality of activities which the operation platform is needs to perform and associating each of said activities with a predetermined sub-array of operation tools; selecting a predetermined activity from said plurality of activities; and registering each operation tool when accommodated within its corresponding operation tool zone.

10. An operation platform according to Claim 8, when dependent on any one of Claims 2 or 3, wherein said accommodating the operation tools of said sub-array of operation tools to their corresponding operation tool zones is performed by coupling said second free end to the compartment of each operation tool of said sub-array and displacing said second free end with the compartment coupled thereto towards the corresponding operation tool zone thereof.

11. An operation platform according to Claim 10, wherein said compartment being displaced towards the corresponding operation tool zone thereof with at least one operation tool facilitated therein.
12. An operation platform according to Claim 8, wherein said accommodating the operation tools of said sub-array of operation tools to their corresponding operation tool zones is performed by coupling said second free end to each operation tool of said sub-array and displacing said second free end with the operation tool coupled thereto towards the corresponding operation tool zone thereof.
13. An operation platform according to any one of Claims 8 to 12, wherein said controlling unit is connectable to an input unit adapted to receive instructions from an operator, for controlling the functioning of the operation platform.
14. An operation platform according to Claim 13, wherein the communication between said input unit and said controlling unit is wireless or wired.
15. An operation platform according to any one of Claims 8 to 14, wherein said selecting at least said one operation tool from said sub-array of operation tools further comprises at least one of the following: identifying the location of the corresponding operation tool zone of the selected operation tool; displacing said second free end towards the corresponding operation tool zone of the selected operation tool; locking said second free end to the selected operation tool; and, taking out that selected operation tool from its corresponding operation tool zone.
16. An operation platform according to any one of Claims 8 to 15, wherein said maneuvering said second free end with at least said one operation tool mounted thereon further comprises at least one of the following: directing said second free end with said at least said one operation tool mounted thereon towards a predetermined operational direction; receiving feedback from at least one external sensor regarding said operation, and, electrically operating the operation tool by delivering electrical signals to the operation tool during operation.
17. An operation platform according to Claim 8, wherein said replacing the operation tool coupled to said second free end with another operation tool comprises at least one of the following: returning the operation tool coupled to its corresponding operation tool zone; de-coupling said second free end from the operation tool; selecting said another operation tool; displacing said second free end towards the corresponding

operation tool zone of the another operation tool; coupling the another operation tool onto the second free end; and, locking the second free end to the another operation tool.

18. An operation platform according to Claim 8, wherein said controlling unit is further adapted to control the rotation of the boom assembly.

19. An operation platform according to any one of the preceding claims, further comprising a tool-carrier connected to said platform base and configured for accommodating at least said one operation tool within corresponding operation tool zones.

20. An operation platform according to Claim 19, when dependent on Claim 8, wherein said tool-carrier is configured for accommodating said sub-array or said array of operation tools.

21. An operation platform according to Claim 19, wherein said tool-carrier comprises a displacement mechanism configured for allowing displacement thereof.

22. An operation platform according to Claim 8, when dependent on Claim 7, wherein said controlling unit further configured for controlling the operation of the operation platform by having said at least one outrigger taking said first transporting state or said second operating state.

23. An operation platform according to any one of the preceding claims, wherein said boom assembly comprises a hydraulic mechanism for operating thereof.

24. An operation platform according to any one of the preceding claims, wherein said at least one operation tool is selected from the group consisting of: hydraulic hammer, power crushing jaws, pinch cutter, steel cutting scissors, concrete crushers, power crushing jaws incorporated with scissors, grapples, clamps for lifting objects, steel shears, hydraulic cutting disc, digging bucket, bores driller, mine clearing tool, and any combination thereof.

25. An operation platform according to any one of the preceding claims, wherein at least said one operation tool zone is configured for receiving therein its corresponding operation tool so as to prevent visual exposure thereof to the environment.

26. An operation platform according to any one of the preceding claims, wherein said platform base is having a side portion configured to incorporate at least said one operation tool zone in their horizontal position.

27. An operation platform according to any one of the preceding claims, wherein at least said one operation tool is having a memory unit adapted to store a plurality of

characteristics associated with its corresponding operation tool, said plurality of characteristics is selected from the group consisting of: identity number of said operation tool, weight of said operation tool, identification number of a corresponding compartment of the operation tool, spatial location of the operation tool on the platform base, identification number of a corresponding operation tool zone of the operation tool, number of total activation hours of the operation tool, type of the operation tool, the activities which said operation tool is configured to perform, the operation which said operation tool is configured to perform, present location of the operation tool, and any combination thereof.

28. An operation platform according to any one of the preceding claims, when dependent on Claim 10, wherein said controlling unit is having a memory unit adapted to store a plurality of characteristics associated with at least said one operation tool, at least said one boom assembly and at least said one operation tool zone, said plurality of characteristics is selected from the group consisting of: identity number of each operation tool, identity number of each operation tool zone, identity number of each boom assembly, weight of each operation tool, identification number of a corresponding compartment of each operation tool, spatial location of the operation tool on the platform base, identification number of a corresponding operation tool zone of each operation tool, number of total activation hours of each operation tool, number of maximal activation hours of each operation tool, type of each operation tool, the activities which said operation tool is configured to perform, the operation which said operation tool is configured to perform, present location of each operation tool, present location of the second free end of each boom assembly, maximum carrying capacity of each boom assembly, occupancy of each boom assembly, occupancy of each operation tool zone, the current operation tool coupled to the boom assembly, the current location of a compartment, and any combination thereof.

29. An operation platform according to any one of Claims 27 or 28, when dependent on Claim 8, wherein at least said one controlling unit is configured to communicate with said memory unit during the control of the operation of the operation platform.

30. An operation platform system, comprising:

- a platform base;

- a movement mechanism connectable to said platform base and, when so connected, configured for displacement of the platform base;

an array of operation tools having at least one operation tool;

at least one operation tool zone on said platform base configured for accommodating thereat at least said one operation tool; and

at least one boom assembly having a first end fixable to said platform base, and a second free end, the boom assembly being controllable for displacing said second free end towards one of said operation tool zones, coupling the second free end to at least said one operation tool accommodated within the operation tool zone, and maneuvering said second free end with at least said one operation tool coupled thereto.

31. An operation platform system according to Claim 30, wherein at least said one operation tool is provided with a corresponding compartment which is mountable at least at said one operation tool zone on the platform base.

32. An operation platform system according to Claim 30, further comprising at least one compartment mounted to said platform base at least at said one operation tool zone, the compartment being configured for receiving therein its corresponding at least said one operation tool.

33. An operation platform system according to any one of claims 31 or 32, further comprising at least one controlling unit configured to control the functioning of the operation platform by performing at least one of the following:

controlling the displacement of said platform base by operating said movement mechanism;

selecting a sub-array of operation tools from said array of operation tools;

accommodating the operation tools of said sub-array of operation tools to their corresponding operation tool zones;

selecting at least said one operation tool from said sub-array of operation tools;

coupling at least said one selected operation tool onto said second free end;

maneuvering said second free end with at least said one operation tool mounted thereon; and,

replacing the operation tool coupled to said second free end with another operation tool.

34. A method for operating an operation platform, comprising:

providing an operation platform, comprising: a platform base; a movement mechanism connectable to said platform base and, when so connected, configured for displacement of the platform base; at least one

operation tool zone on said platform base configured for accommodating thereat at least one operation tool; and at least one boom assembly having a first end fixable to said platform base, and a second free end;

displacing said second free end of said boom assembly towards at least said one operation tool zone;

coupling the second free end to at least said one operation tool accommodated within the operation tool zone; and,

maneuvering said second free end with at least said one operation tool coupled thereto.

35. A method according to Claim 34, further comprising steps of providing at least said one operation tool with a corresponding compartment, and mounting the compartment within at least at said one operation tool zone on the platform base.

36. method according to any one of Claims 34 or 35, further comprising steps of providing said operation platform with at least one controlling unit, and controlling the functioning of the operation platform by performing at least one of the following:

controlling the displacement of said platform base by operating said movement mechanism;

selecting a sub-array of operation tools from an array of operation tools;

accommodating the operation tools of said sub-array of operation tools to their corresponding operation tool zones;

selecting at least said one operation tool from said sub-array of operation tools;

coupling at least said one selected operation tool onto said second free end;

maneuvering said second free end with at least said one operation tool mounted thereon; and,

replacing the operation tool coupled to said second free end with another operation tool.

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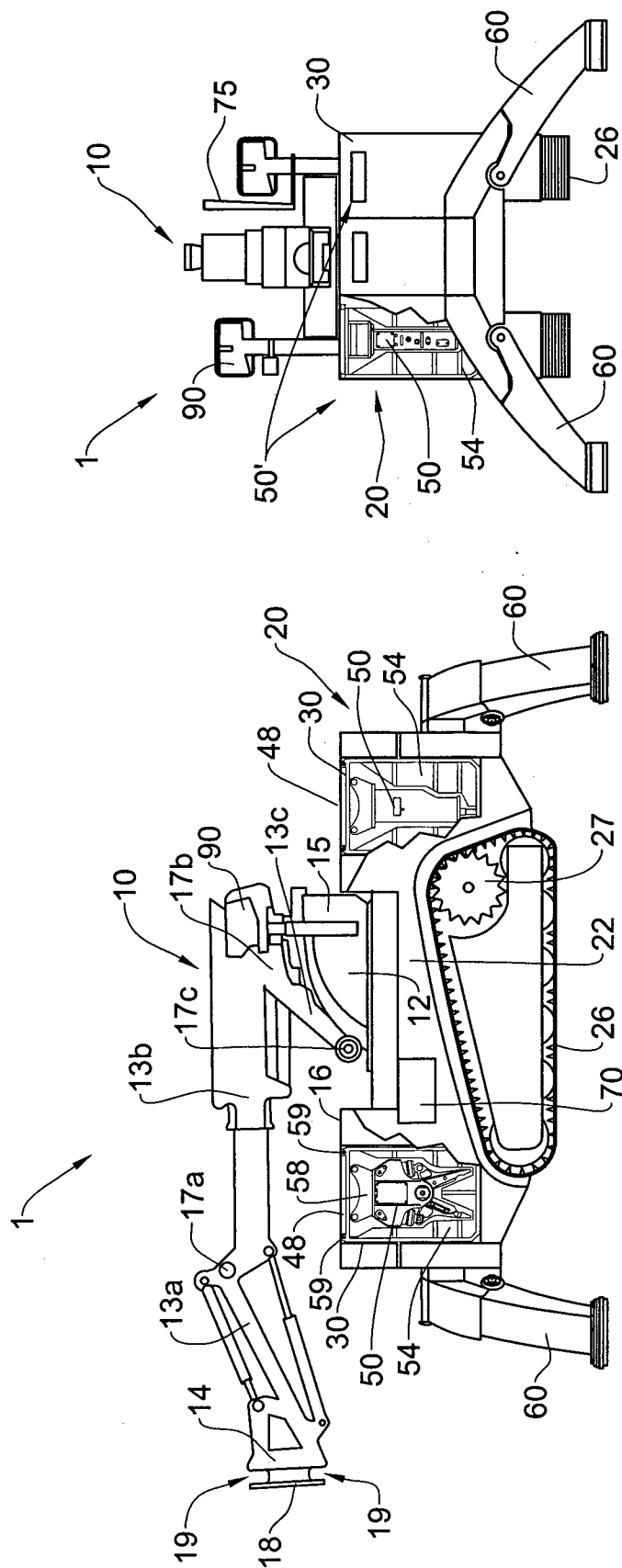


FIG. 1B

FIG. 1A

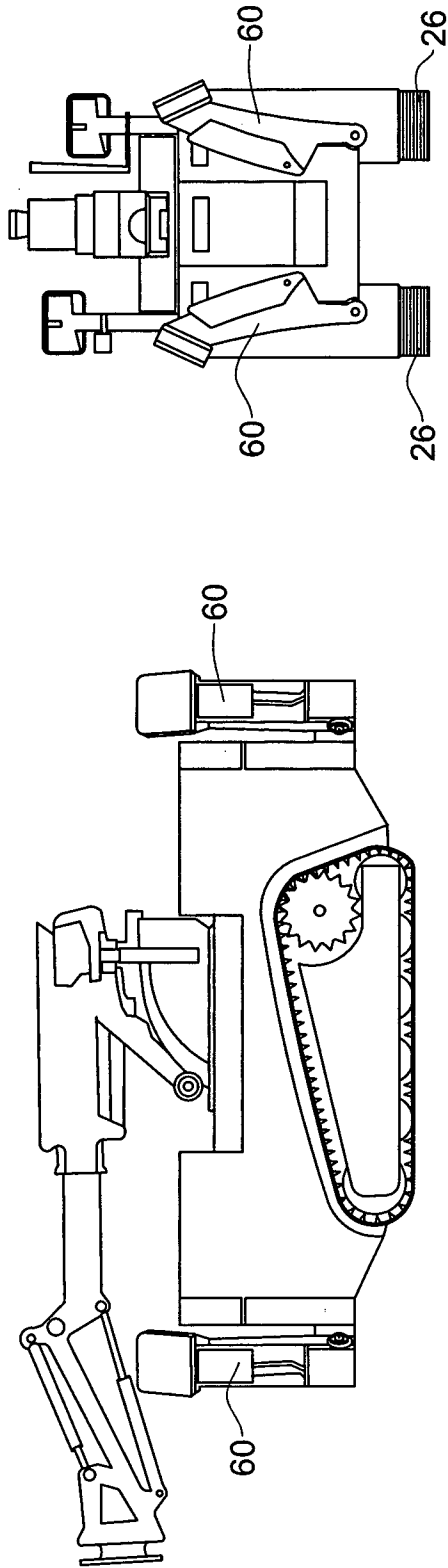


FIG. 2B

FIG. 2A

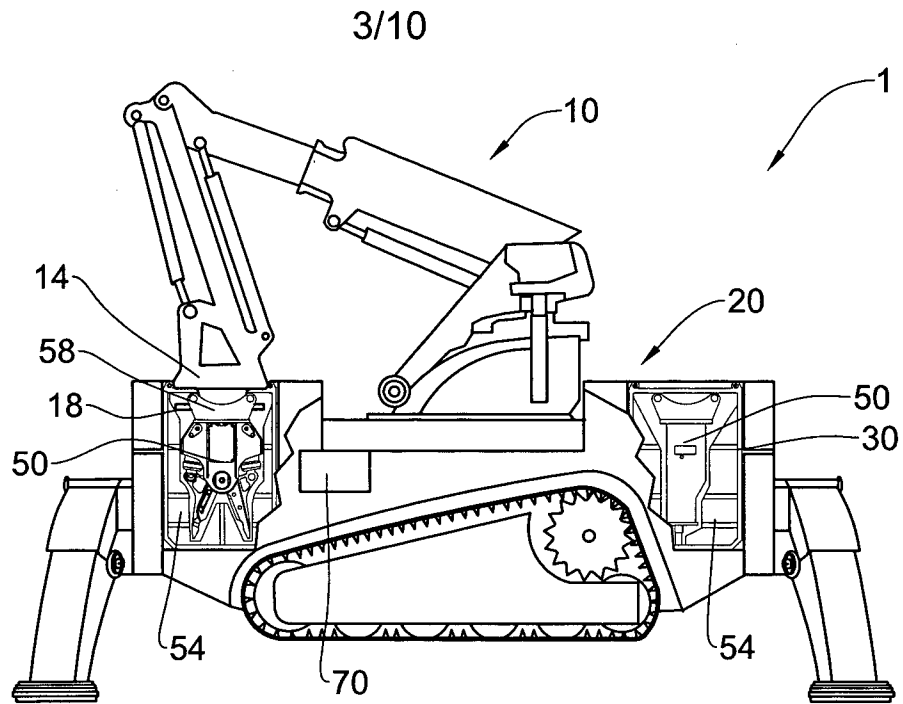


FIG. 3A

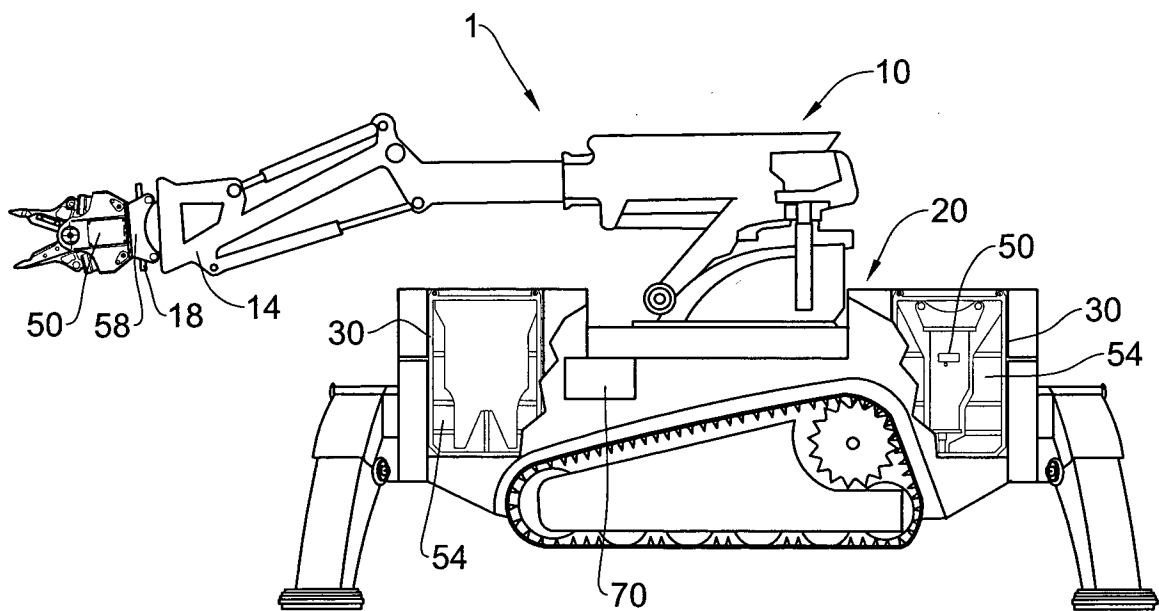


FIG. 3B

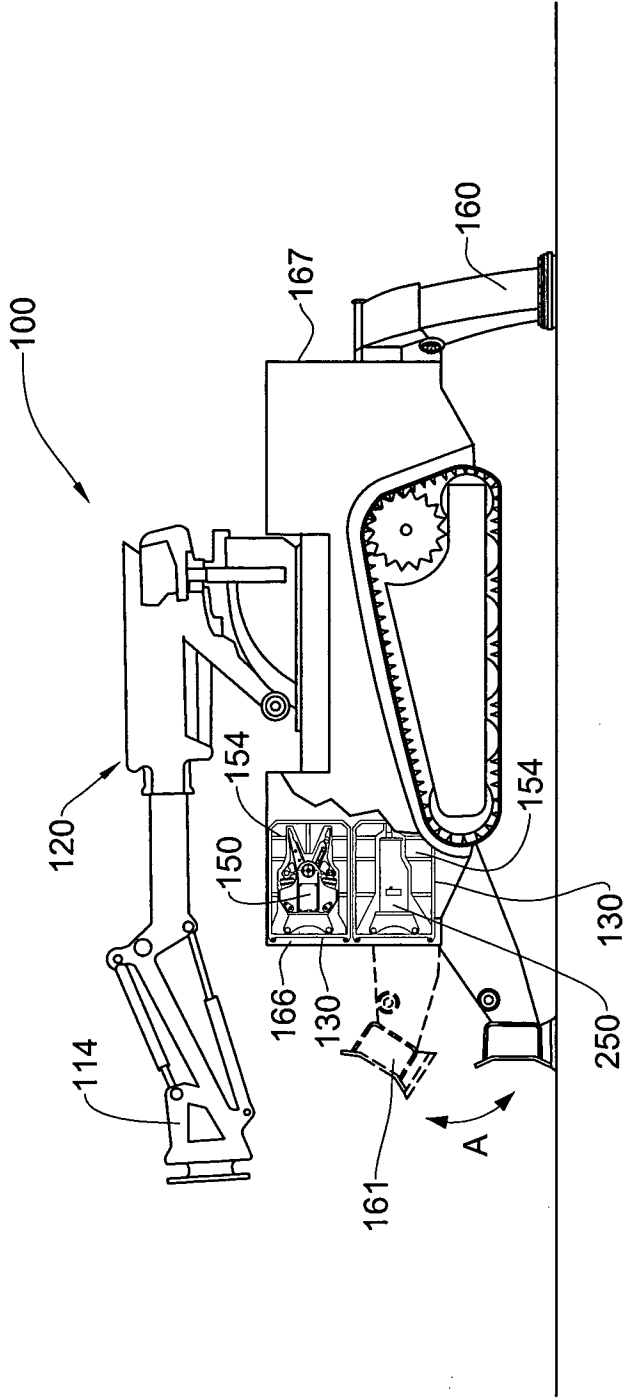


FIG. 4

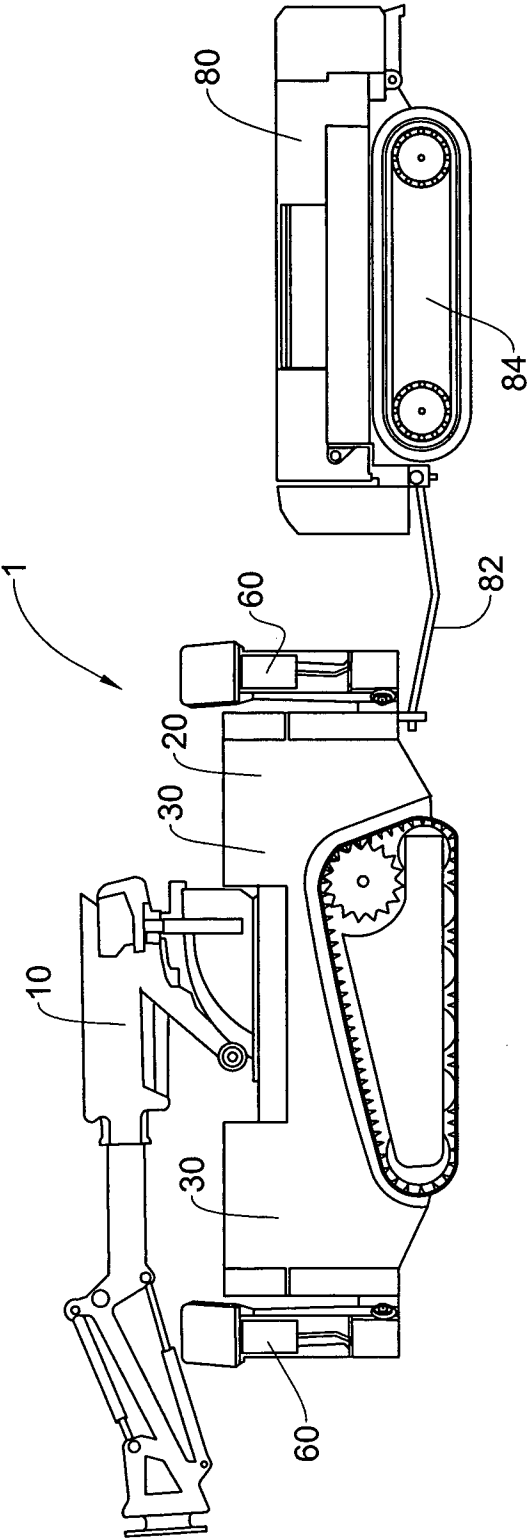


FIG. 5A

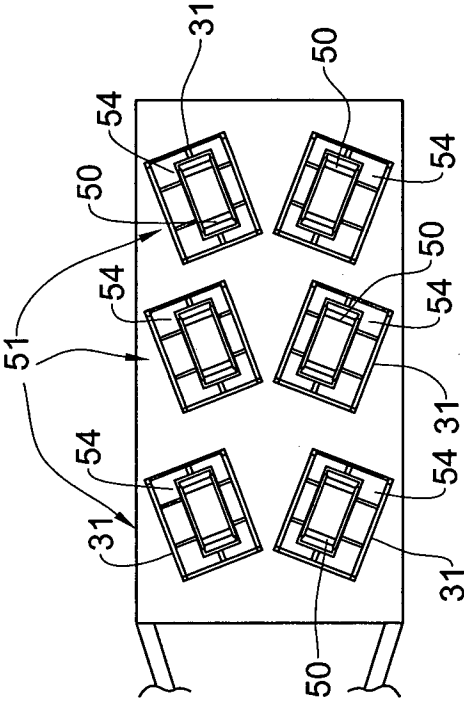


FIG. 5B

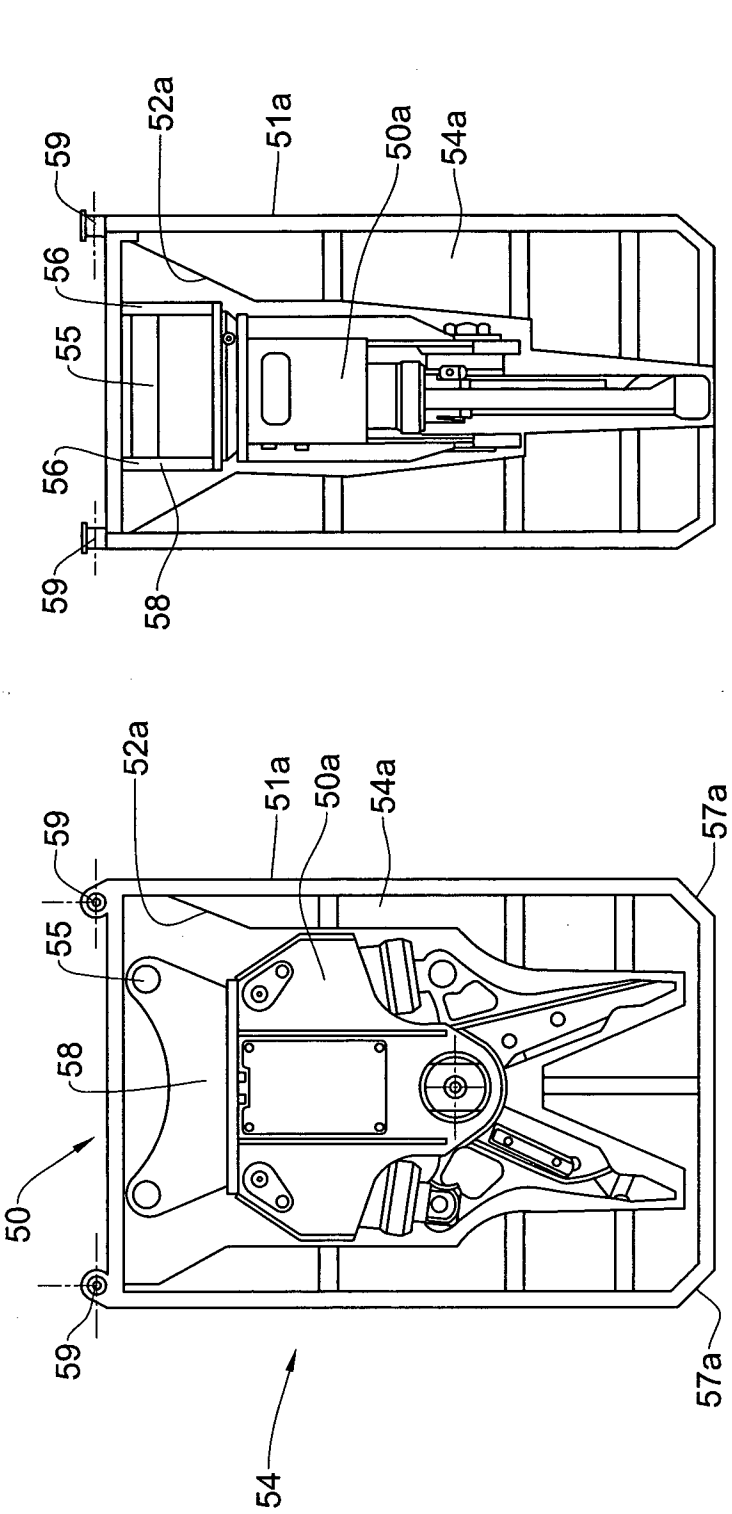


FIG. 6B

FIG. 6A

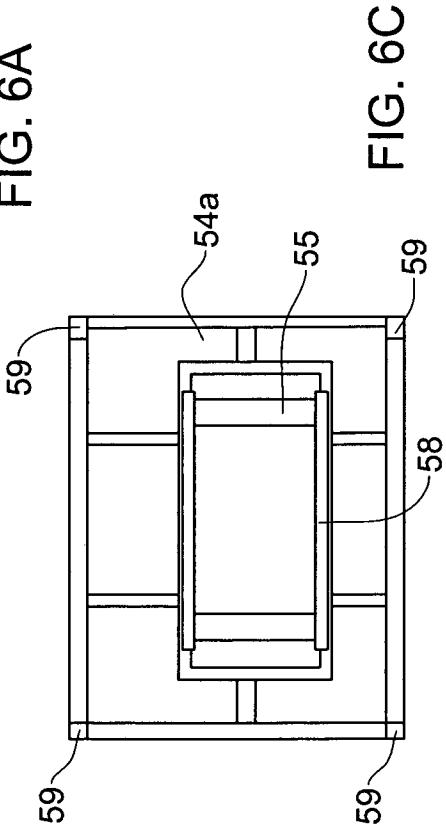
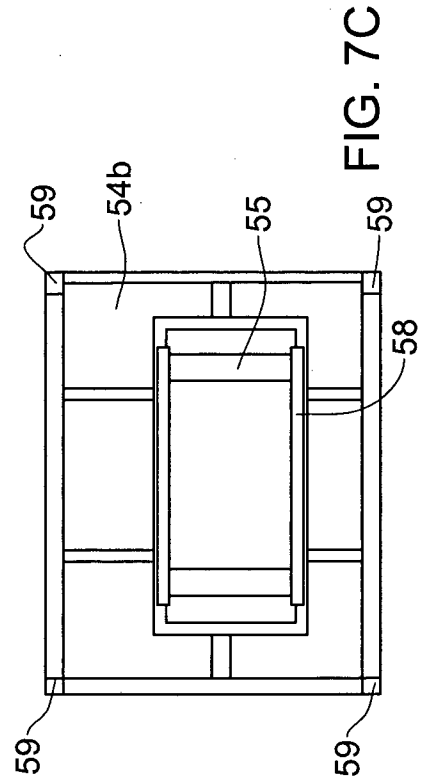
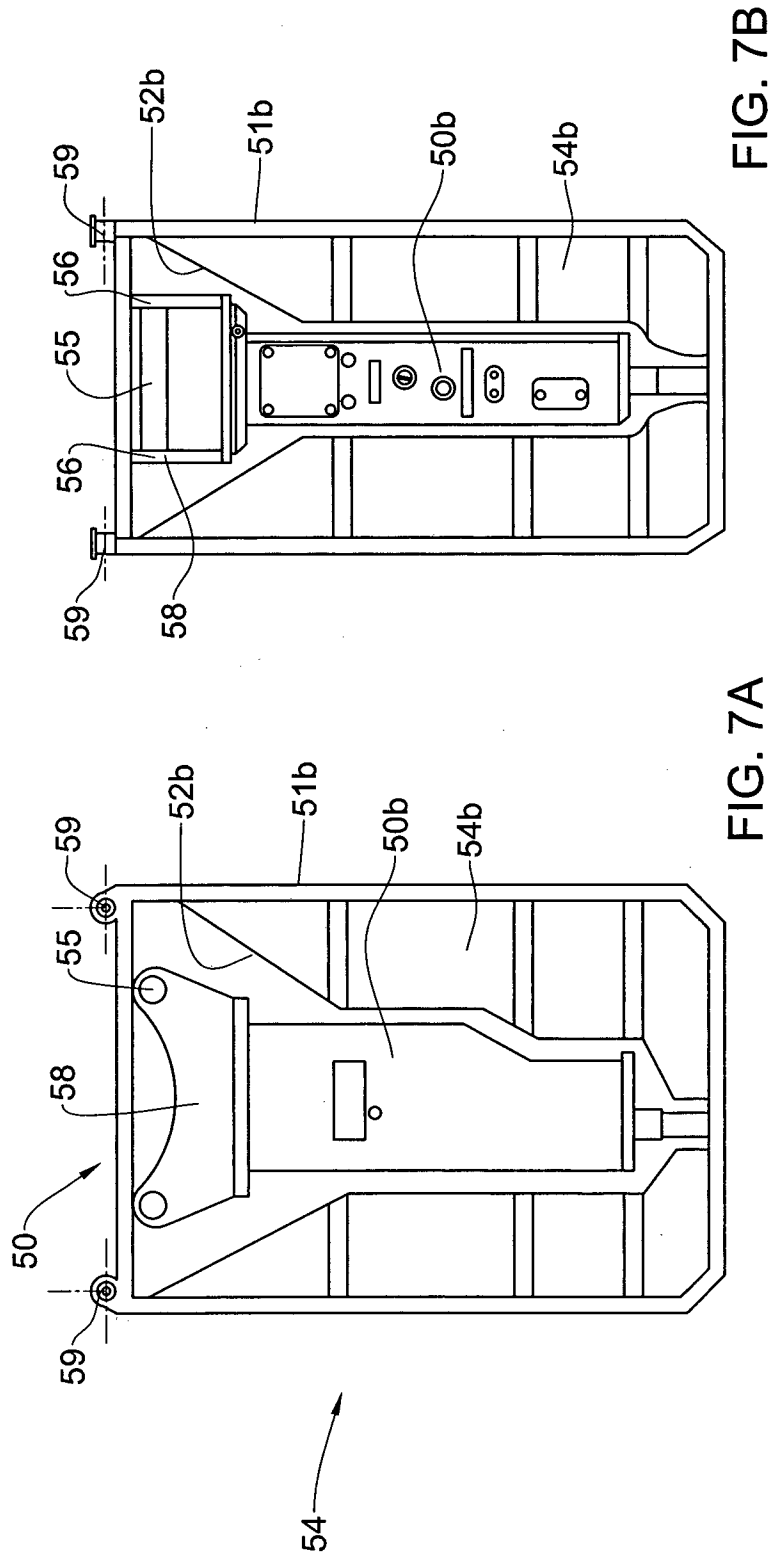


FIG. 6C



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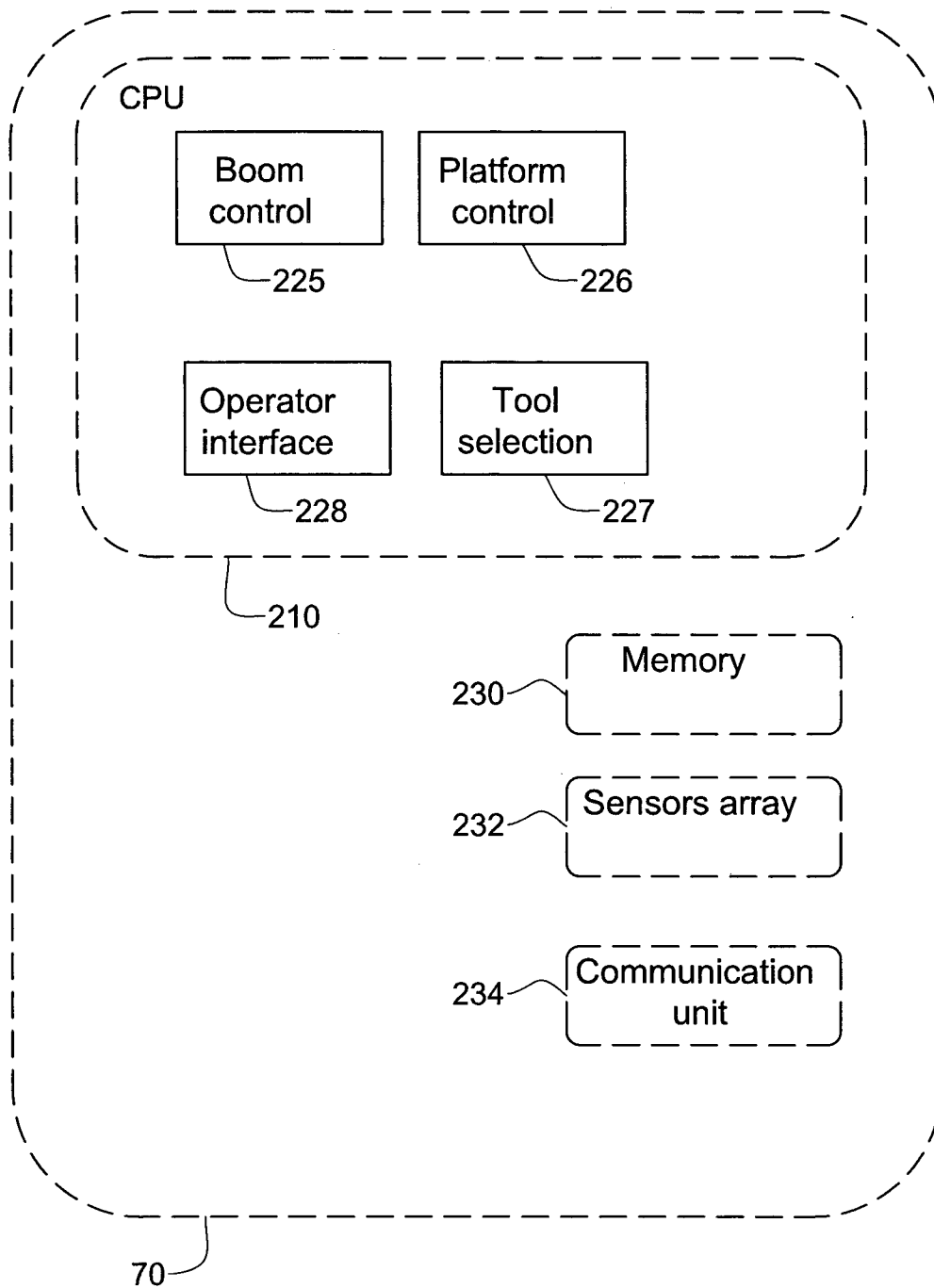


FIG. 8

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| 310 Attachment element ID | 311 Tools type compatibility | 312 Occupied | 313 Tool ID | 314 Location coordinates |
|---------------------------------|---|-----------------|----------------|--------------------------------|
| X1 | Hydraulic Hammer type 126 | YES | T01 | X1, Y1, Z1 |
| X2 | Concrete crasher type 31 | YES | Null | X2, Y2, Z2 |
| X3 | Demotion grapples type15 / Multipurpose grapples type 35 | YES | T02 | X3, Y3, Z3/ X4, Y4, Z4 |

FIG. 9

| 410 Attachment element ID | 411 Location | 412 Work Hours | 413 Weight | 414 Tools type |
|---------------------------------|-----------------|----------------------|---------------|---------------------------------|
| T01 | X01 | 0 | 270 kg | Hydraulic Hammer type 126 |
| T02 | X03 | 15.5 | 170 kg | Demotion grapples type 15 |
| T18 | B01 | 0 | 200 kg | Concrete crasher type 31 |

FIG. 10

| 510 Boom Assembly ID | 511 Location coordinates | 512 Max. Carrying Capacity | 513 Occupied |
|----------------------------|--------------------------------|----------------------------------|-----------------|
| B01 | X1, Y1, Z1 | 550 kg | Yes |
| B02 | X2, Y2, Z2 | 1080 kg | No |

FIG. 11

10/10

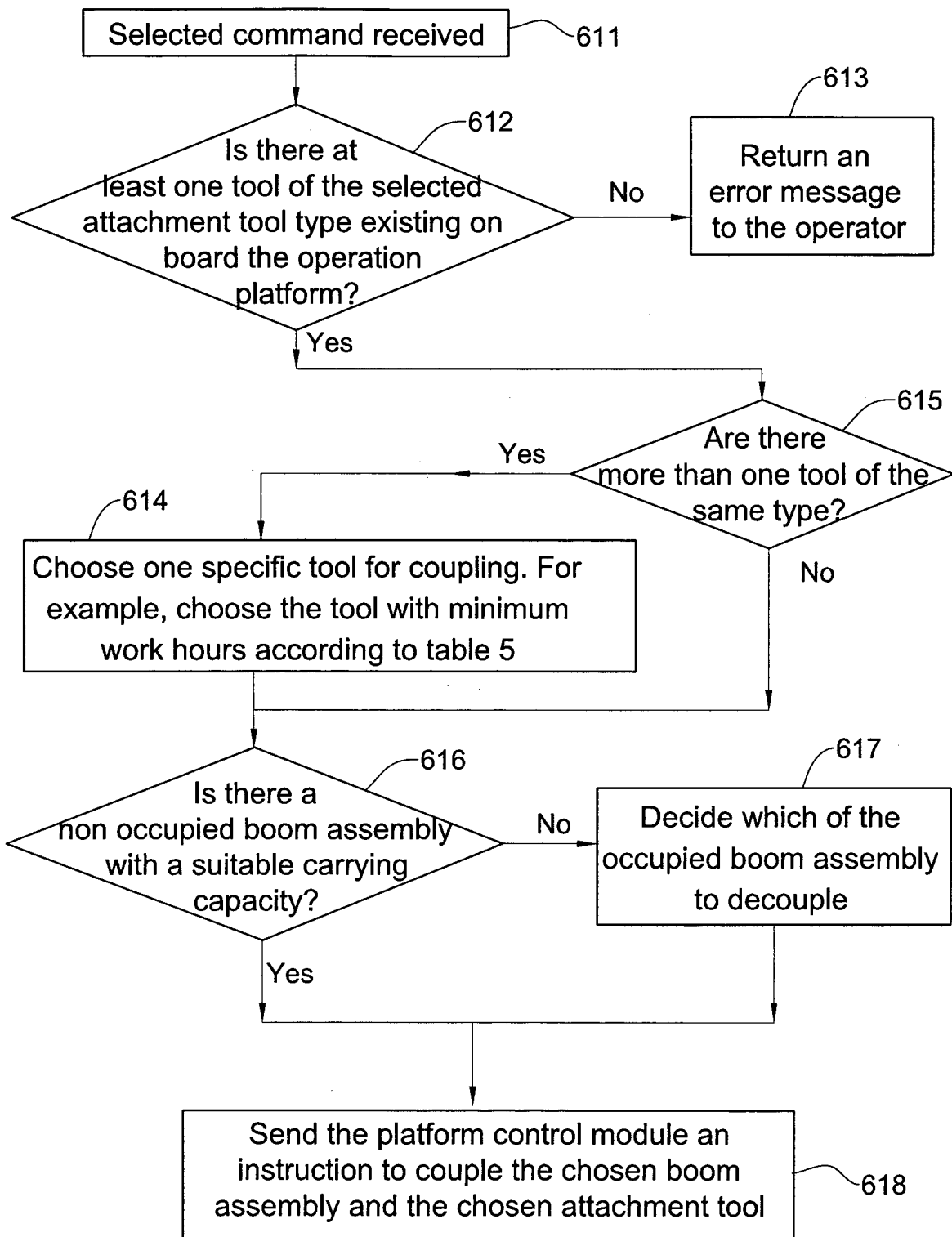


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2011/000294

| A. CLASSIFICATION OF SUBJECT MATTER INV. F41H7/00 B25J5/00 F41H11/16 ADD. | | |
|--|---|---|
| According to International Patent Classification (IPC) or to both national classification and IPC | | |
| B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F41H B25J | | |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched | | |
| Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| X | US 5 017 084 A (LEMELSON JEROME H [US]) 21 May 1991 (1991-05-21) | 1-9, 12-18, 22-27, 29-36 19-21 |
| Y | abstract; figures 1-3,8-12 column 1, line 31 - line 50 column 2, line 61 - column 3, line 7 column 5, line 44 - line 57 column 6, line 43 - line 50 column 7, line 59 - line 68 column 23, line 3 - column 25, line 35 ----- | |
| Y | US 2009/302575 A1 (ARCHER GEOFFREY C [US] ET AL) 10 December 2009 (2009-12-10) figure 4 paragraph [0003] - paragraph [0005] paragraph [0017] ----- -/-- | 19-21 |
| <div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex. </div> | | |
| <div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div> | | |
| Date of the actual completion of the international search <div style="text-align: center; font-size: 1.2em;">3 August 2011</div> | | Date of mailing of the international search report <div style="text-align: center; font-size: 1.2em;">11/08/2011</div> |
| Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016 | | Authorized officer <div style="text-align: center; font-size: 1.2em;">Schwingel, Dirk</div> |

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International application No

PCT/IL2011/000294

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|--|---|--|
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| X | <p>US 2010/068024 A1 (AGENS MICHAEL W [US]) 18 March 2010 (2010-03-18)</p> <p>abstract; figures 13-18c paragraph [0060] paragraph [0064] - paragraph [0070] -----</p> | <p>1-3,5,6, 8-18, 23-25, 27-36</p> |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2011/000294

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
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| US 5017084 | A | 21-05-1991 | NONE | |
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| US 2009302575 | A1 | 10-12-2009 | NONE | |
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| US 2010068024 | A1 | 18-03-2010 | NONE | |
| ----- | | | | |