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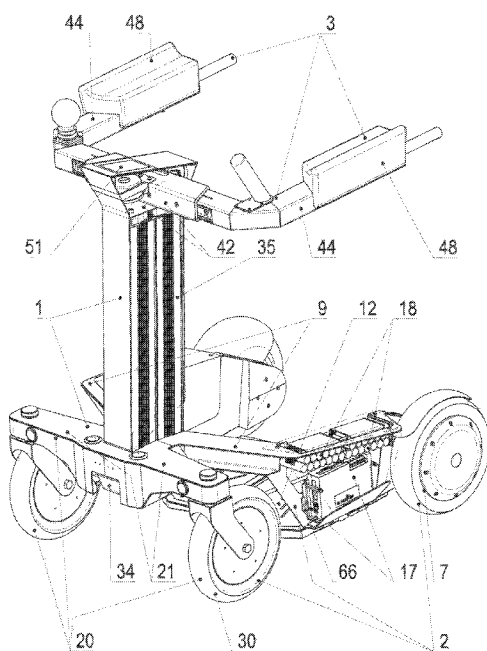


FIG. 1

(57) Abstract: An electric multirobot (1) consists of a chassis (2) and a user interface (3) interconnected by a linear column (35); while the chassis (2) consists of a frame consisting of a front axle (20) formed by a shaped beam (21) equipped with variably interchangeable front non-driven wheels (30) and sides (9); while the rear part of the chassis (2) frame is fitted with wheel units (7) with an integrated drive; while a footboard (12) is mounted swingably in each of the sides (9); while the frame is equipped with elements of electronics (17), a control system (66), and electric accumulators (18); while the front axle (20) is fitted with a shaped anchoring base (34) of the linear column (35) to the upper part of which the user interface (3) is anchored by means of a central support structure (42) which includes bearing elbow supports (44) equipped with ergonomic forearm supports (48) in its rear parts; while a control display (51) is placed on the central supporting structure (42).

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Electric multirobot to support walking and transport

TECHNICAL FIELD

An electric multirobot to support walking and transport belongs to the field of versatile and multipurpose training devices for maintaining physical condition, intended for the rehabilitation processes of patients, partially immobile persons, physically disabled people, seniors, for supporting unassisted life, and for ensuring the process of everyday life, including use for leisure activities.

DESCRIPTION OF THE PRIOR ART

Currently, there is no robotic technology according to the solution in the world markets – the electric multirobot with the ability to transfigure its technology between its use as a robotic device for user- or assistance-controlled gait rehabilitation, and between its use as a full-fledged means of transport for ride in standing position, with outdoor and indoor use, in an institutional, domestic, or outdoor environment.

Products of global companies, among which there can be included German companies such as BEMOTEC GmbH with the Beactive+e (patent EP3013302), and eMovements with the ELLO; Japanese companies Nabtesco Corp with the COMPAL (patents EP3391869B1; EP3205322A1; EP3153147A1; EP3308761B1; EP3075369A1; EP3000456B1), as well as FRANCE BED with the Robot Assist Smart Walker "RW-01", or Chinese companies such as Genteel with the Electric Rollator and others, are single-purpose devices oriented only to support and increase the stability of the user with the associated purpose of developing movement skills in the form of gait rehabilitation - for example the Otto Bock company – especially the Xeno type – verticalizing wheelchair, and many others which enable ride in sitting and standing position, but do not include the function of gait rehabilitation, with a robotic transfiguration system enabling the combination of the function of the rehabilitation process and the function of ride in

standing position, with the extension of the usability of the assistance control of the gait rehabilitation process or user transport.

The presented solution of the electric multirobot, both in comparison with the above-mentioned devices and with a number of other currently known solutions, combines several different functions in one technology - the function of height adjustment of the support skeleton – elbow supports and handles, through an electronically controlled control telescopic central column, the function of electronically controlled wheel units, the function of folding footboards to ensure a combination of the function of controlled gait rehabilitation and controlled transport of the user while standing, outdoors and indoors, with the advantage of using all functions both during normal operational and leisure activities, as well as in a home or institutional environment for purposeful use to the rehabilitation processes of gait training.

The closest state of the art to the presented solution is a Multirobot for transport and rehabilitation according to the CZ 309495 B6 document.

However, the above-mentioned solution of the multirobot has disadvantages in terms of driving characteristics, control elements, ergonomics, and the possibility of a range of applications. At the same time, the disadvantage is that the device is bulky, and its transport is complicated, which is due to its large external dimensions and weight. As for the power supply, it is not solved in an optimal way, both in terms of dimensional and weight parameters, as well as in terms of safety in the event of a power failure and the possibility of compensation for the given event. The solution of the device specified in the CZ 309495 B6 document also lacks the flexibility of construction required for the wide variation in height and physical parameters of users. Due to the need to meet the requirements of a wide range of users, it also lacks quick and simple modifiability, especially in the user interface. At the same time, it does not have anti-collision elements.

SUMMARY OF THE INVENTION

The mentioned disadvantages are eliminated by the Electric multirobot to support walking and transport which consists of a chassis and a user interface connected to each other by a linear column; while the main part of the chassis is a frame consisting of a front axle formed by a shaped beam equipped with front non-driven wheels and sides; while the shaped beam with an internal passage space connects to the sides where the wiring harnesses are installed; while the sides are equipped with wheel units with an integrated drive in their rear part; while in each of the sides of the lower part of the frame, there are lugs fixed from the inside in which the footboard is mounted swingly; while the frame is equipped with mounting plates with elements of electronics, a control system, and electric accumulators; while the electric accumulator comprises independent electric accumulator modules interconnected by a cable line with a central output for connection to the power supply terminals of the elements of electronics; while the front axle is fitted with a shaped anchoring base of the linear column to the upper part of which the user interface is anchored by means of a central support structure, which includes bearing elbow supports fitted with ergonomic forearm supports in its rear part; while the central support structure is fitted with an emergency switch and a control display equipped with display and process icons.

Furthermore, it is advantageous when the chassis frame is a shell frame.

Furthermore, it is advantageous when the chassis frame is a profile frame.

Furthermore, it is advantageous when the frame has transverse cylindrical flanges in the rear part in its overhung ends, and further electromagnetic brake stators inserted into them; while the centre of the transverse cylindrical flange and the stator of the electromagnetic brake passes through the bearing of the shaft of the wheel unit with an integrated drive, on the inner cover of which there is a brake blade of the electromagnetic brake integrated.

Furthermore, it is advantageous when the front non-driven wheels are freely rotatable wheel units.

Furthermore, it is advantageous when the front non-driven wheels are omnidirectional wheel units.

Furthermore, it is advantageous when the footboard is pivotally mounted in the lugs by means of a pin, sliding sleeves and a friction hinge; while the lugs of the footboard segment are fitted with reinforcing ribs with a stop on the outer side.

Furthermore, it is advantageous when the shell frame above the level of the pendulum bearing of the footboards is provided with a visible cover abutting the access to the inner space of each of the sides, where the mounting plates are installed.

Furthermore, it is advantageous when the profile frame above the level of the pendulum bearing of the footboards is equipped with switchboard boxes where the mounting plates are installed.

Furthermore, it is advantageous when the front axle of the frame consists of a shaped beam with a vertical housing inserted on the sides for bearings, spacer segments and a vertical pin of freely rotatable wheel units.

Furthermore, it is advantageous when the vertical pin of the freely rotatable wheel unit is part of the fork to which the front non-driven wheel is fixed.

Furthermore, it is advantageous when the vertical pin of the omnidirectional wheel unit is part of the cantilever fork with a shaped rib connected to the shaped beam.

Furthermore, it is advantageous when the shape beam of the front axle of the shell frame is equipped with a pendulum bearing of the shaped anchoring base of the linear column; while the pendulum bearing consists of sliding bearings and a horizontal pin; while locks are installed on the sides of the shaped anchoring base of the column into which the fixing eyes of the shaped anchoring base of the column are attached; while

the locks are also equipped with pulling rods with a subsequent mechanical switch situated on the shaped beam.

Furthermore, it is advantageous when the shaped beam of the front axle of the profile frame is fitted on the sides with a mounting flange to which the shaped anchoring base of the linear column is attached.

Furthermore, it is advantageous when the shaped anchoring base of the linear column is rigidly connected to the front axle and sides.

Furthermore, it is advantageous when part of the central supporting structure are linear wirings into which the bearing elbow supports equipped with a unified flange are installed, while the central supporting structure being fitted with locking elements.

Furthermore, it is advantageous when friction segments are part of the central support structure, followed by the bearing elbow supports incorporating a unified flange, the central support structure is provided with locking elements.

Furthermore, it is advantageous when the unified flange is fitted with a control element.

Furthermore, it is advantageous when the unified flange is fitted with a gripping stabilising element.

Furthermore, it is advantageous when the bearing elbow supports are fitted with a system of pressure control with horizontal handles.

Furthermore, it is advantageous when the inner space of the central support structure is equipped with an ambient environment sensory subsystem.

Furthermore, it is advantageous when the control display located on the central support structure is equipped with a speed icon, a distance icon, a column height icon, a parking brake icon, a lighting icon, a control mode switching icon, a driving mode setting icon, and a user option setting icon.

Advantages of the solution:

- the flexibility of the structure, operationally adaptable to a wide range of height and physical parameters of users
- variable configuration options according to the currently preferred operating environment and the user's preferences for how to control the multirobot
- fast and simple modifiability of the device, especially the user interface
- storability and easy transport of the device
- simple interchangeability of variants of control elements due to individual health limitations, technological access, and user experience, including flexible switching of the position within the device right/left side
- a unique type of battery system with low dimensional and weight parameters with simultaneous assurance of safety in the event of a power failure with the possibility of compensation for the given event
- function of folding the telescopic column
- anti-collision and safety elements, safety system with fall detection

Description of Drawings

Figures and legend are shown on the attached sheets.

- FIG. 1 overall axonometric view of the electric multirobot
- FIG. 2 front axonometric view of the electric multirobot in a design with the shell frame and front freely rotatable wheel units
- FIG. 3 front axonometric view of the electric multirobot in a design with the shell frame and front omnidirectional wheel units
- FIG. 4 rear axonometric view of the electric multirobot with extended linear column and a system of pressure control
- FIG. 5 rear axonometric view of the electric multirobot – showing the variability of the front wheel units and control/grip elements
- FIG. 6 view of the electric multirobot in the transport position - with the linear column folded down
- FIG. 7 view of the freely rotatable wheel unit - section
- FIG. 8 view of the omnidirectional wheel unit – section
- FIG. 9 view of the wheel unit with integrated drive - section
- FIG. 10 detailed view of the linear column tilting system
- FIG. 11 schematic representation of the control display equipped with icons

- FIG. 12 axonometric view of an electric multirobot in a design with the profile frame and a representation of the system of electric accumulators, electronics, and control system
- FIG. 13 axonometric view of the electric multirobot in a design with the profile frame and omnidirectional wheel units
- FIG. 14 detailed view of the freely rotatable wheel unit and its connections to the shaped beam
- FIG. 15 detailed view of the shaped anchoring base and its pendulum bearing
- FIG. 16 view of the fixed installation of the shaped anchoring base in the shell frame
- FIG. 17 view of the fixed installation of the shaped anchoring base in the profile frame

An example of the invention version

Electric multirobot 1 designed in two technical variants for transport and rehabilitation consists of two main subassemblies which are the chassis 2 and the user interface 3.

The main part of the chassis 2 is a sight shell frame 4A, alternatively a profile frame 4B of U-shaped plan, having at the rear part at its overhung ends transverse cylindrical flanges 5 and a stator 6 of an electromagnetic brake further inserted therein, while through the centre of the transverse cylindrical flange 5 and the stator 6 of the electromagnetic brake passes the shaft bearing of the wheel unit 7 with integrated drive on the inner cover of which the brake blade 8 of the electromagnetic brake is integrated. In each of the sides 9 of the lower part of the shell frame 4A, or alternatively of the profile frame 4B, there are lugs 10 inserted on the inner side in which a footboard 12 is pivotally mounted by means of a pin, sliding sleeves and a friction hinge 11, wherein the lugs 10 of the footboard 12 segment are fitted on the outer side with reinforcing ribs 13 with a stop 14; while the shell frame 4A is provided with a sight cover 15 above the level of the pendulum bearing of the footboards 12, extending down to the penetration into the interior of each of the sides 9 where the mounting plates 16 with the electronics 17, the control system 66, and electrical accumulators 18 are installed; while the inner space of the shell frame 4A interconnects the shaped beam 21 in the front part with the inner passageway space adjacent to the partial sides 9 where wiring harnesses are installed in the inner spaces of the structure, alternatively the profile frame 4B is provided with switchboard boxes 62 above the level of the of the pendulum bearing of the footboards 12, wherein mounting plates 16 are installed with the elements of the electronics 17, the control system 66, and the electric accumulators 18; while in the front part, the profile frame 4B interconnects the shaped beam 21 with the inner through space adjacent to the partial sides 9 where the wiring harnesses are installed.

The electric accumulator 18 comprises a group of four independent electric accumulator modules 19 interconnected by a cable line with a central output for connection to the power supply terminals of the elements of the electronics 17.

The front axle 20 of the shell frame 4A, alternatively of the profile frame 4B, comprises a shaped beam 21 with laterally inserted vertical housings 22 for the bearings 23, distance segments 24, and a vertical pin 25 of the freely rotatable wheel units 26,

alternatively of the fixed mounting of the omnidirectional wheel units 27; the vertical pins 25 of the alternative wheel units 26, 27 are terminated by a sight screw 28.

The vertical pin 25 of the freely rotatable wheel unit 26 is part of the fork 29 to which the front non-driven wheel 30 is fixed, alternatively, in the case of omnidirectional wheel units 27, the vertical pin 25 is part of the cantilever fork 31 with the shaped rib 32 connected to the shaped beam 21.

The central part of the shaped beam 21 of the front axle 20 of the shell frame 4A is provided with a pendulum bearing 33 of the shaped anchoring base 34 of the linear column 35 at the point of connection to the sides 9; while the pendulum bearing is formed by a pair of plain bearings 36 and a horizontal pin 37, at the same time a pair of locks 38 is installed in the central part on the sides of the shaped anchoring base 34 into which the fixing eyes 39 of the shaped anchoring base 34 are fixed, the locks are also provided with pulling rods 40 with an associated mechanical switch 41 located on the view side of the shaped beam 21; alternatively, the central part of the shaped beam 21 of the front axle 20 of the profile frame 4B is fitted laterally with a mounting flange 63 into which the shaped anchoring base 34 of the linear column 35 is fixed by means of a screw connection. Alternatively, the shaped anchoring base 34 of the linear column 35 is rigidly connected to the front axle 20, and the pair of sidewalls 9 of both the shell frame 4A and the profile frame 4B.

The outer side of the shaped beam 21 of the front axle 20 is fitted with a front light 64 in the front part, while at the same time wheel unit covers 7 and cylindrical flanges 5 are installed in the rear part of each of the sides 9 into which the rear lights 64 are integrated.

The user interface 3 is anchored to the top of the linear column 35 by a central support structure 42 which includes a pair of linear wirings 43; alternatively, a group of friction segments 65 with an integrated locking element 67 into which there are bearing elbow supports 44 installed which include a unified flange 45 of a control element 46 and a gripping stabilizing element 47. At the same time, at the rear the bearing elbow supports 44 are fitted with a pair of ergonomic forearm supports 48 and a modular system 49 of pressure control with horizontal handles 50 which is installed in the interior of the bearing elbow supports 44.

A control display 51 and an emergency switch 60 are provided within the upper view part of the central support structure 42, and an ambient environment sensory subsystem 61 is provided within the interior space of the central support structure 42. The control display 51 is provided with display and process icons that include a speed icon 52, a distance icon 53, a column height icon 54, a parking brake icon 55, a lighting icon 56, a control mode switching icon 57, a driving mode setting icon 58, and a user option setting icon 59.

Functions

The electric multirobot 1 for transport and walking support is designed for rehabilitation or leisure time support of users with physical limitations. This implies the necessary functions and purpose which are ensured by the composition of the functions and the technical arrangement of the electric multirobot 1.

User mobility support is provided by a chassis 2 complemented by a user interface 3.

The shape arrangement of the chassis 2 with the action elements deriving the movement of the electric multirobot 1 creates a working space in its inner part for the movement of the user's lower limbs, or for standing by means of folding footboards 12 situated in the inner part.

The user interface 3 is used to position and maintain the user in a standing position with forearm support via a pair of 4B ergonomic forearm supports allowing the user reach to control all necessary functions.

The supporting part of the chassis 2 is the sight shell frame 4Au, or alternatively a U-shaped profile frame 4B to which the partial subsystems of the electric multirobot 1 are attached.

In the rear part of the sight shell frame 4A, alternatively of the profile frame 4B, there are transverse cylindrical flanges 5 in which there are inserted electromagnetic brake stators 6 through which passes the shaft of the wheel unit 7 with integrated drive which induces the desired movement of the electric multirobot 1, and at the same time, with a brake blade 8 installed on the outer housing of the wheel unit, which, if required, is in contact with electromagnetic brake stator 6, thereby producing the desired braking effect of the electric multirobot 1.

The sides 9 of the shell frame 4A, or alternatively of the profile frame 4B are provided on the inside with lugs 10 through which the pin passes in the sliding bushings which creates, through the lugs 10 of the footboard 12, a swinging connection of the bearing supplemented in the axis of rotation by a friction hinge 11 which dampens the speed of the swinging movement; while on the outside the lugs 10 are fitted with reinforcing ribs 13 with a subsequent stop 14 which ensures a stable geometric position of the footboard 12 in relation to the chassis 2.

The side 9 of the shell frame 4A is provided externally with a sight cover 15 to prevent the ingress of IPx4 liquid and solid contaminants into the interior of each of the sides 9 where the mounting plates 16 are installed, containing the electronics 17, control system 66, and electrical batteries 18 providing power and control of the system of the electric multirobot 1; while the interconnection of the wiring harnesses of the elements of the electronics 17 and the electric accumulators 18 is drawn through the inner space of the sides 9 which are interconnected by the shaped beam 21 with the adjacent inner through space.

Alternatively, the sides 9 of the profile frame 4B above the level of the swinging footboard 12 are fitted with switchboard boxes 62, preventing the ingress of liquid and solid impurities of IPx4 category into the interior space where the mounting plates 16 are installed with the elements of the electronics 17, the control system 66, and the electric accumulators 18, while in the front the profile frame 4B part interconnects the shaped beam 21 with the inner passageway space adjacent the partial sides 9, and the switchboard boxes 62 where the wiring harnesses are installed.

The electric accumulator 18, consisting of a group of four independent electric accumulator modules 19 interconnected by a cable line with a central output, ensures, even in the event of failure or malfunction of a sub-independent module 19 the continuous distribution of electrical energy to the terminals of the elements of electronics 17 only with the effect of a proportional reduction of the total capacity and therefore of the range.

The defined functionality ensures the safety of operation regarding the multiple provisioning or distribution of the power supply function among multiple elements.

The front axle 20 of the shell frame 4A, alternatively of a profile frame 4B, comprising the shaped beam 21 with a laterally inserted vertical housing 22 designed for the installation of an assembly of the bearing 23, a distance segment 24, and a vertical pin

25 forming a rotational linkage of freely rotatable wheel units 26, alternatively of a fixed mounting of omnidirectional wheel units 27; while the vertical pins 25 of the wheel units 26, 27 are secured against movement in the axis of the pin 25 by the sight bolt 28.

The vertical pin 25 of the freely rotatable wheel unit 26 is part of the fork 29 into which the front non-powered wheel 30 is mounted, alternatively in the case of the omnidirectional wheel units 27, the vertical pin 25 is part of the cantilever fork 29 with the shaped rib 32 extending down to the shaped beam 21, thereby defining a rigid coupling of the assembly of the cantilever fork 31 to the shaped beam 21.

At the point of connection to the sides 9, the central part of the shaped beam 21 of the front axle 20 of the shell frame 4A is provided with the pendulum bearing 33 of the shaped anchoring base 34 through which it is possible to fold the linear column 35 with the associated user interface 3 into the transport position.

The pendulum bearing 33 creating a rotational link is formed by a pair of sliding bearings 36 and a horizontal pin 37; at the same time, a pair of locks 38 is installed in the middle part on the sides of the shaped anchoring base 34 into which the fixing eyes 39 of the shaped anchoring base 34 are attached, thereby ensuring the defined working position of the user interface 3; at the same time, the locks are equipped with pulling rods 40 with a subsequent mechanical switch 41 located on the visible side of the shaped beam 21, enabling flexible unlocking of the pair of locks 38 and moving the user interface 3 to the transport position.

Alternatively, the central part of the shaped beam 21 of the front axle 20 of the profile frame 4B is fitted on the sides with a mounting flange 63 to which the shaped anchoring base 34 of the linear column 35 is firmly fixed by means of a screw connection, enabling operative adjustment of the height of the subsequent user interface 3.

The user interface 3 is firmly attached to the upper part of the linear column 35 by means of a central supporting structure 42 which includes a pair of linear wiring 43; alternatively, a group of friction segments 65 creating a linear movement link enabling the operative adjustment of the width of the connected bearing elbow supports 44 which include a unified flange 45 of the control element 46 and a gripping stabilization element 47, enabling mutual interchangeability within the right and left positions of the control element 46; at the same time, within the central supporting structure 42 on the sides, there is a pair of locking elements 67 integrated which define the position of the bearing elbow supports 44 chosen by the user.

At the same time, in the rear part the bearing elbow supports 44 are fitted with a pair of ergonomic forearm supports 48 and a system 49 of pressure control with horizontal handles 50 enabling the control of the electric multirobot 1 by applying pull or pressure to the horizontal handles 50.

Within the upper view part of the central supporting structure 42, there is an emergency switch 60 installed, deriving an immediate stop through the derived braking torque of the stators 6 of the electromagnetic brake with the brake blade 8 and disconnecting the system from the integrated power supply; at the same time, the control display 51 is located in the given area by means of icons visually interpreting all the set parameters and current states of the electric multirobot 1, with the possibility of user individualization of the limit parameters of the speed and height of the extension of the linear column 35 through the software means of communication of the control display 51 with the basic control system of the electronic elements 17.

The control display 51 therefore interprets an interface with the possibility of reading and setting values or parameters both by the manufacturer and the user of the device. The control display 51 is equipped with display and process icons where the display icons visualize system states such as, for example, the current battery states, the height of the linear column 35, the current speed, the distance travelled. The process icons give commands to the electronic elements 16 with a request to change the state, for example speed limitation using the speed icon 52, lighting activation using the lighting icon 56, changing the height of the linear column or setting the position memory using the column height icon 54, setting parameters in relation to the distance travelled (partial routes, as well as long-term distance) using the distance icon 53, activating the parking brake using the parking brake icon 55, further choosing the control method using the control mode switching icon 57, setting the required driving mode parameters using the driving mode setting icon 58, and saving the individual driving mode according to the needs of a specific user using the user selection setting icon 59.

The inner space of the central supporting structure 42 is also equipped with an ambient environment sensory subsystem 61 through which the space in front of the electric multirobot 1 is monitored, linked to the evaluation and prevention of a potential collision, the user's position is monitored simultaneously, while in case of loss of the user's position, the movement of the electric multirobot 1 will stop.

Through the icons interpreted on the display interface 51, it is possible to define the final assembly of the multirobot 1 in the production process regarding the type and position of the installed modular elements, among which the control element 46, the system 49 of pressure control or the sensor subsystem 61 can be included, thereby activating a specific software module integrated within the elements of electronics 17.

Industrial Use

The electric multirobot for transport and rehabilitation is designed for rehabilitation or recreational support of users as a multipurpose therapeutic, rehabilitation, and training device to maintain physical fitness and to provide support for everyday life.

List of the Positions Used

- 1) electric multirobot
- 2) chassis
- 3) user interface
- 4) 4A shell frame; 4B profile frame
- 5) transverse cylindrical flanges
- 6) electromagnetic brake stator
- 7) wheel unit with integrated drive
- 8) brake blade of the electromagnetic brake
- 9) side
- 10) lugs
- 11) friction hinge
- 12) footboard
- 13) reinforcing ribs
- 14) stop
- 15) sight cover
- 16) mounting plate
- 17) electronics
- 18) electric accumulator
- 19) electric accumulator module
- 20) front axle
- 21) shaped beam
- 22) vertical housing
- 23) bearing
- 24) distance segment
- 25) vertical pin
- 26) freely rotatable wheel unit
- 27) omnidirectional wheel unit
- 28) sight screw
- 29) fork
- 30) non-powered front wheel
- 31) cantilever fork
- 32) shaped rib

- 33) pendulum bearing
- 34) shaped anchoring base
- 35) linear column
- 36) sliding bearing
- 37) horizontal pin
- 38) lock
- 39) fixing eye of the shaped anchoring base
- 40) pulling rod
- 41) mechanical switch
- 42) central supporting structure
- 43) linear wiring
- 44) elbow support
- 45) flange
- 46) control element
- 47) gripping stabilizing element
- 48) ergonomic forearm support
- 49) system of pressure control
- 50) horizontal handle
- 51) control display
- 52) speed icon
- 53) distance icon
- 54) column height icon
- 55) parking brake icon
- 56) lighting icon
- 57) control mode switching icon
- 58) driving mode settings icon
- 59) user option settings icon
- 60) emergency switch
- 61) sensory subsystem
- 62) switchboard boxes
- 63) mounting flange
- 64) lights
- 65) friction segments

66) control system

67) locking element

Claims

1. An electric multirobot (1) to support walking and transport **characterized in that**

it consists of a chassis (2) and a user interface (3) interconnected by a linear column (35); while the main part of the chassis (2) is a frame (4) consisting of a front axle (20) formed by a shaped beam (21) equipped with front non-driven wheels (30) and sides (9);

while the shaped beam (21) with an internal passage space connects to the sides (9) where the wiring harnesses are installed, while the sides (9) are equipped with wheel units (7) with an integrated drive in their rear part;

while into each of the sides (9) of the lower part of the frame (4) from the inside, there are lugs (10) fixed in which the footboard (12) is pivotably mounted; while the frame (4) is equipped with mounting plates (16) with elements of electronics (17), control system (66), and electric accumulators (18); while the electric accumulator (18) consists of independent electric accumulator modules (19) interconnected by a cable line with a central output intended for connection to the power terminals of the elements of electronics (17);

while the front axle (20) is fitted with a shaped anchoring base (34) of a linear column (35) to the upper part of which the user interface (3) is anchored by means of a central support structure (42) which includes bearing elbow supports (44) fitted with ergonomic forearm supports (48) in the rear parts, the central support structure (42) is equipped with an emergency switch (60) and a control display (51) equipped with display and process icons.

2. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**

the chassis frame (4) is a shell frame (4A).

3. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**

the chassis frame (4) is a profile frame (4B).

4. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**
the frame (4) has transverse cylindrical flanges (5) in the rear part, in its overhung ends, and electromagnetic brake stators (6) inserted into them, while through the centre of the transverse cylindrical flange (5) and the electromagnetic brake stator (6) there passes the bearing of the shaft of the wheel unit (7) with an integrated drive, on the inner cover of which the brake blade (8) of the electromagnetic brake is integrated.
5. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**
the front non-driven wheels (30) are freely rotatable wheel units (26).
6. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**
the front non-driven wheels (30) are omnidirectional wheel units (27).
7. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**
the footboard (12) is pivotally mounted in the lugs (10) by means of a pin, sliding bushings and friction hinge (11), while the lugs (10) of the footboard (12) segment are fitted on the outside with reinforcing ribs (13) with a stop (14).
8. The electric multirobot (1) to support walking and transport of claims 1 and 2 **characterized in that**
the shell frame (4A) is provided above the level of the pendulum bearing of the footboards (12) with a sight cover (15) abutting the penetration into the inner space of each of the sides (9) where the mounting plates (16) are installed.

9. The electric multirobot (1) to support walking and transport of claims 1 and 3
characterized in that

the profile frame (4B) is equipped with switchboard boxes (62) above the level of the of the pendulum bearing of the footboards (12) where the mounting plates (16) are installed.

10. The electric multirobot (1) to support walking and transport of claims 1 and 5
characterized in that

the front axle (20) of the frame (4) consists of a shaped beam (21) with a vertical housing (22) inserted on the sides for bearings (23), spacer segments (24), and a vertical pin (25) of freely rotatable wheel units (26).

11. The electric multirobot (1) to support walking and transport of claims 1 and 6
characterized in that

the front axle (20) of the frame (4) consists of a shaped beam (21) with a vertical housing (22) inserted on the sides for bearings (23), spacer segments (24), and a vertical pin (25) for fixed mounting of omnidirectional wheel units (27).

12. The electric multirobot (1) to support walking and transport of claims 1, 5 and 10
characterized in that

the vertical pin (25) of the freely rotatable wheel unit (26) is part of the fork (29) to which the front non-driven wheel (30) is fixed.

13. The electric multirobot (1) to support walking and transport of claims 1, 6 and 11
characterized in that

the vertical pin (25) of the omnidirectional wheel unit (27) is part of the cantilever fork (31) with the shaped rib (32) connected to the shaped beam (21).

14. The electric multirobot (1) to support walking and transport of claims 1 and 2 **characterized in that**

the shaped beam (21) of the front axle (20) of the shell frame (4A) is equipped with a pendulum bearing (33) of the shaped anchoring base (34) of the linear column (35), while the pendulum bearing consists of sliding bearings (36) and a horizontal pin (37); while on the sides of the shaped anchoring base (34), there are locks (38) installed into which the fixing eyes (39) of the shaped anchoring base (34) are attached, while the locks are also equipped with pulling rods (40) with a connected mechanical switch (41) located on the shaped beam (21).

15. The electric multirobot (1) to support walking and transport of claims 1 and/or 3 **characterized in that**

tvarový nosník (21) přední nápravy (20) profilového rámu (4B) je po stranách osazen montážní přírubou (63) do které je uchycen nosný koš (34) lineárního sloupu (35).

16. The electric multirobot (1) to support walking and transport of claims 1 and/or 2 and/or 3 **characterized in that**

the shaped anchoring base (34) of the linear column (35) is firmly connected to the front axle (20) and the sides (9).

17. The electric multirobot (1) to support walking and transport of claims 1 and 2 **characterized in that**

the central support structure (42) includes linear wirings (43) into which supporting the bearing elbow supports (44) fitted with a unified flange (45) are installed, while the central support structure (42) is fitted with locking elements (67).

18.The electric multirobot (1) to support walking and transport of claims 1 and 3 **characterized in that**

part of the central supporting structure (42) are friction segments (65) connected to bearing elbow supports (44) which include a unified flange (45), while the central supporting structure (42) is equipped with locking elements (67).

19.The electric multirobot (1) to support walking and transport of claims 1 and/or 17 and/or 18 **characterized in that**

the unified flange (45) is fitted with a control element (46).

20.The electric multirobot (1) to support walking and transport of claims 1 and/or 17 and/or 18 **characterized in that**

the unified flange (45) is fitted with a gripping stabilizing element (47).

21.The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**

the bearing elbow supports (44) are equipped with a system (49) of pressure control with horizontal handles (50).

22.The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**

the inner space of the central supporting structure (42) is equipped with an ambient environment sensory subsystem (61).

23. The electric multirobot (1) to support walking and transport of claim 1 **characterized in that**

the control display (51) located on the central support structure (42) is equipped with a speed icon (52), a distance icon (53), a column height (54), a parking brake icon (55), a lighting icon (56), control mode switching icon (57), a driving mode settings icon (58), and an user option settings icon (59).

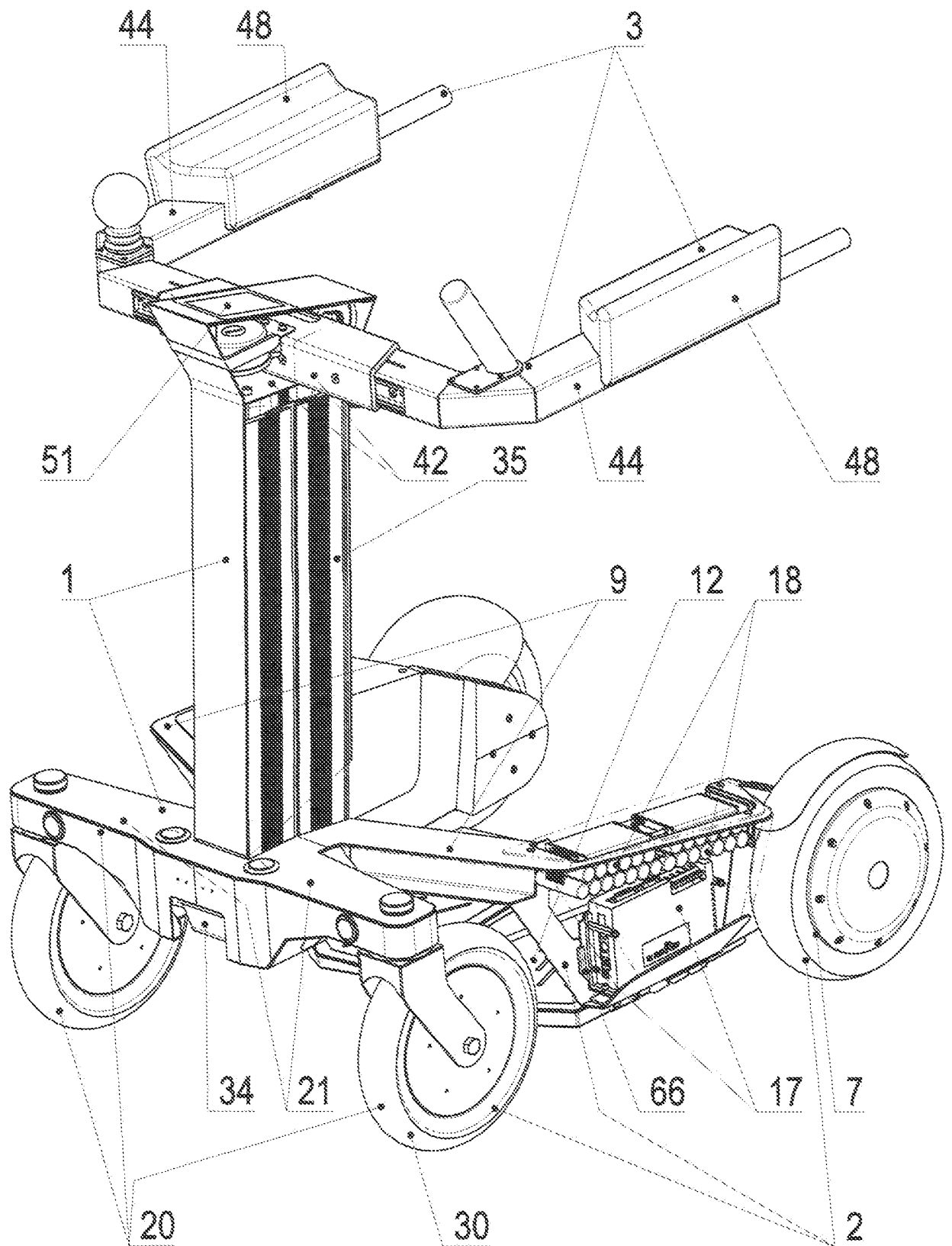


FIG.1

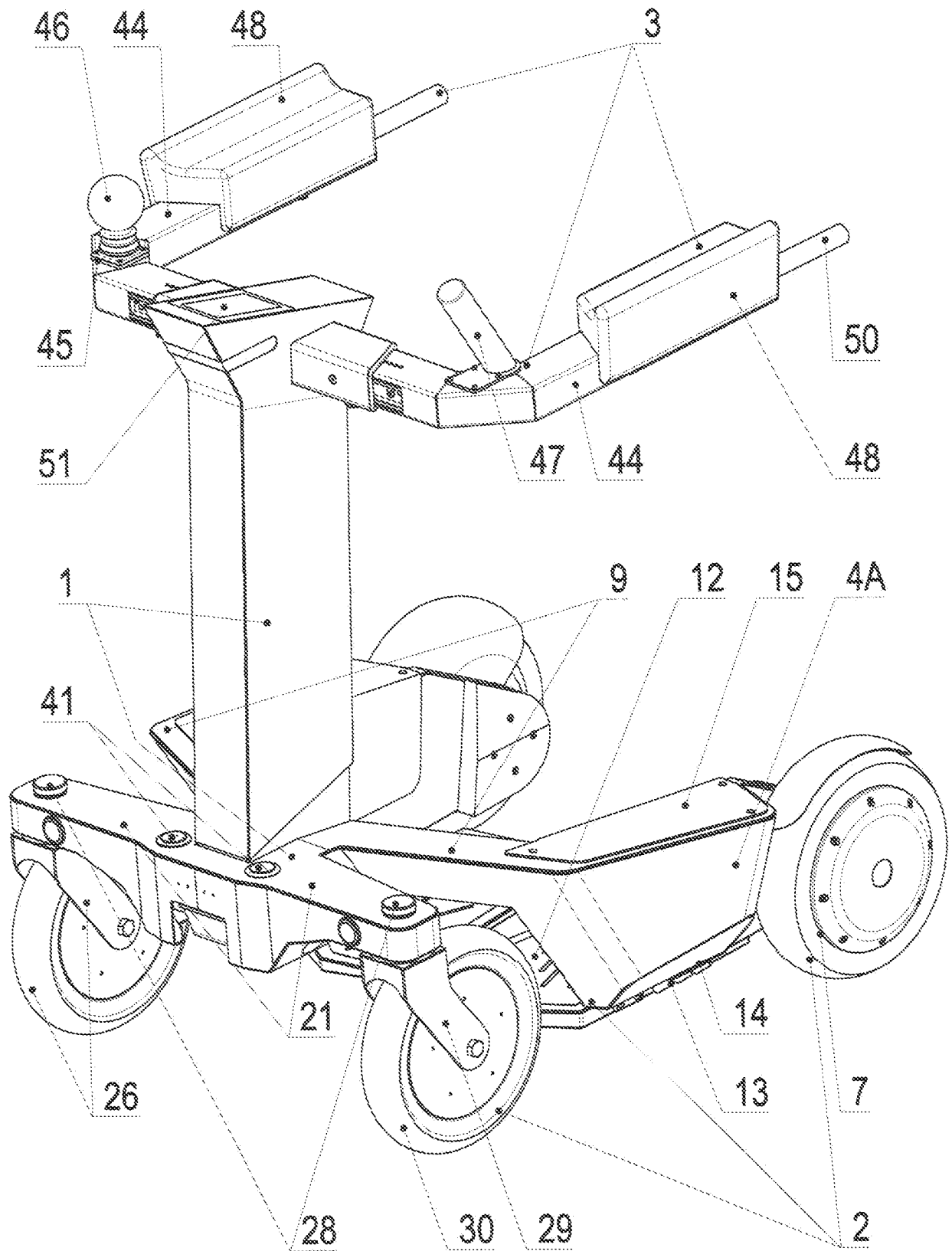


FIG.2

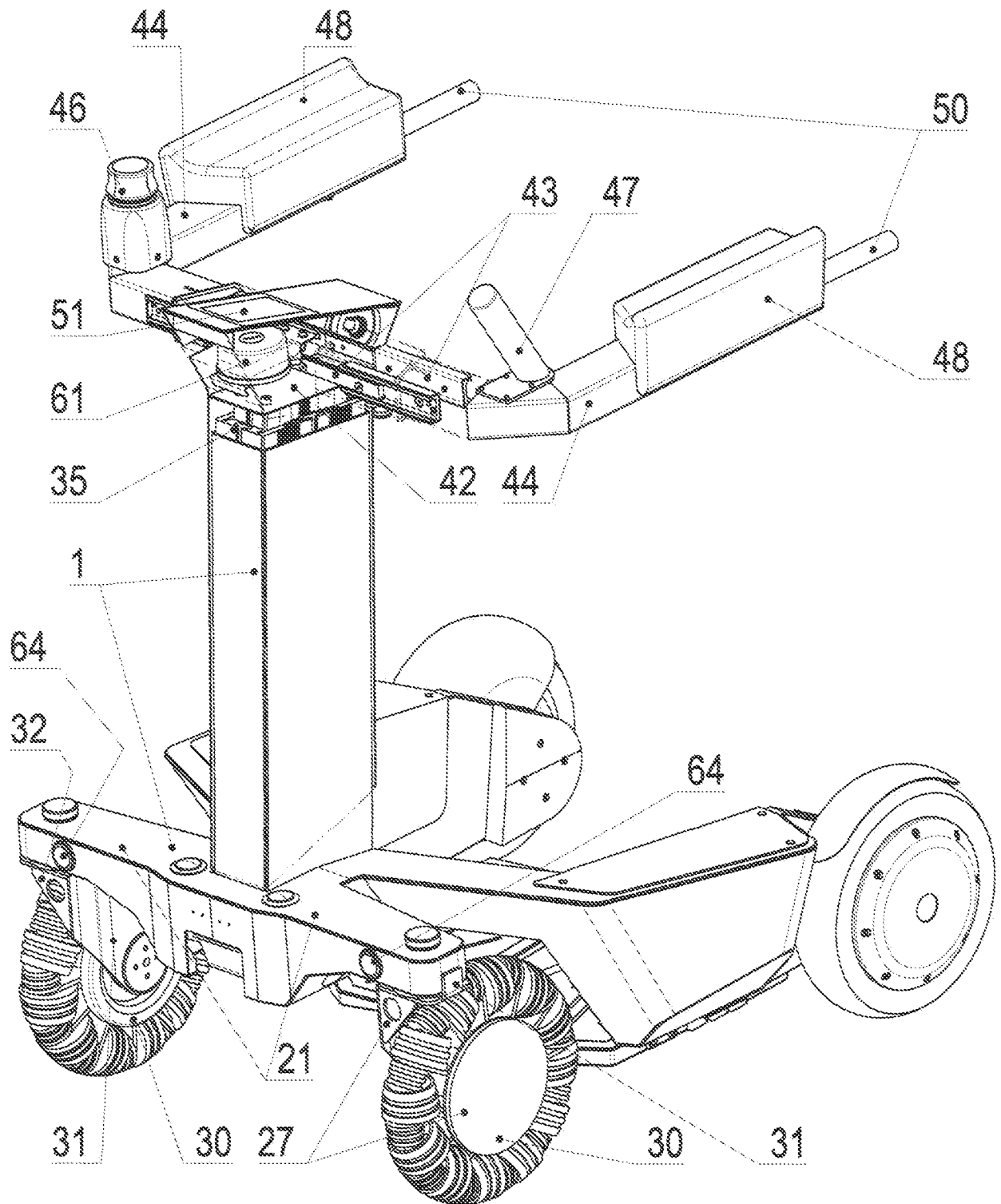


FIG.3

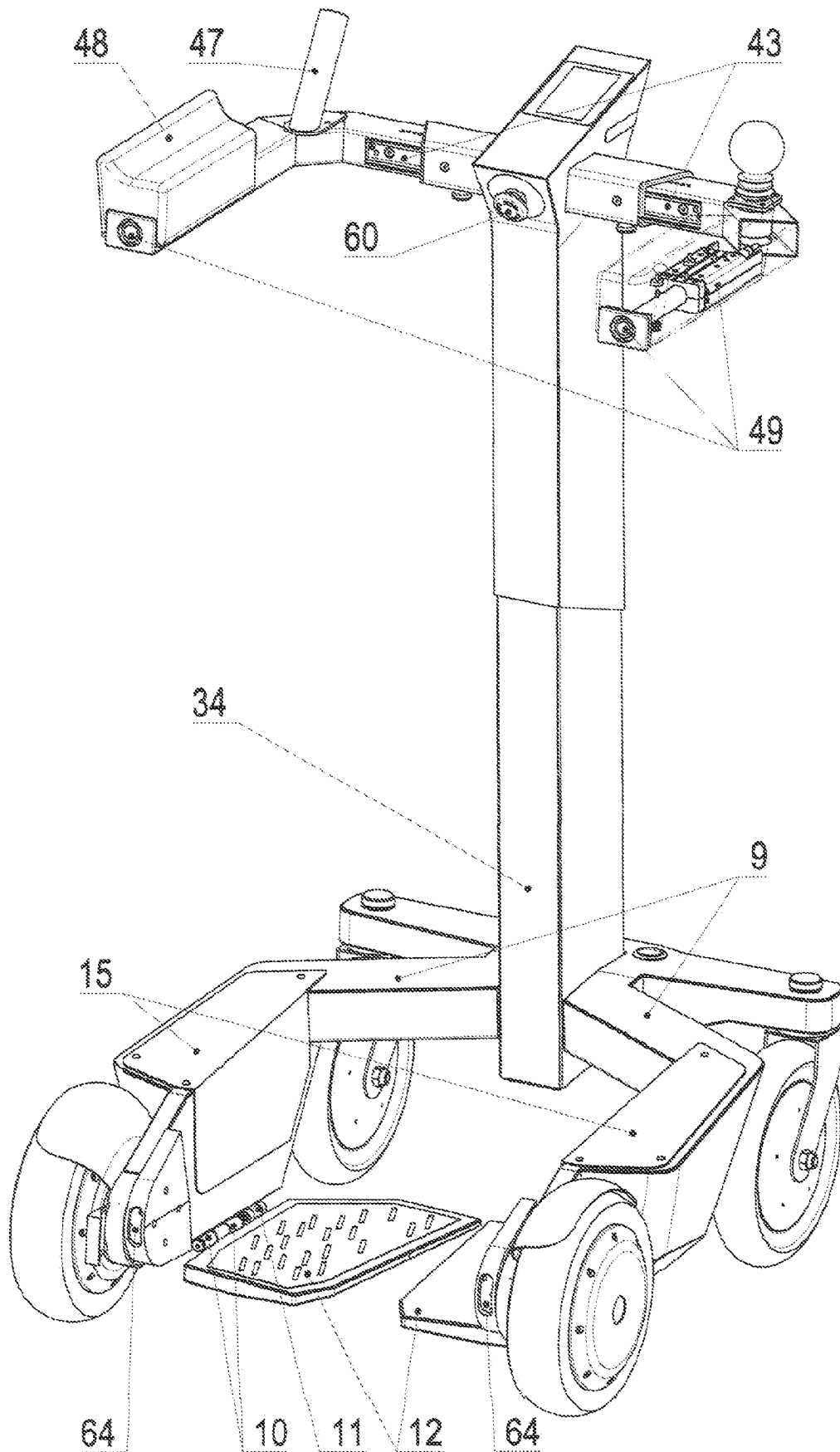


FIG.4

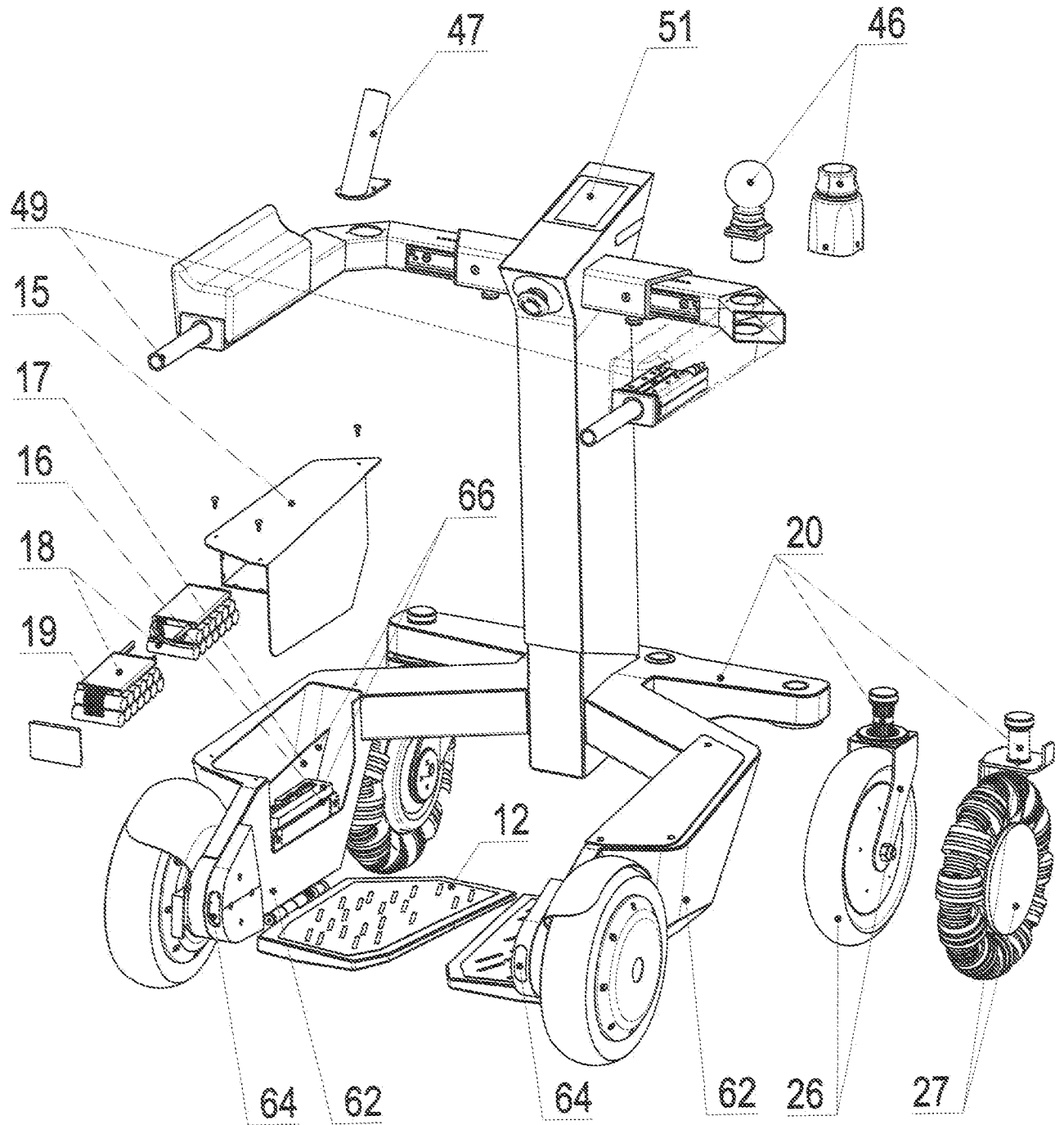


FIG.5

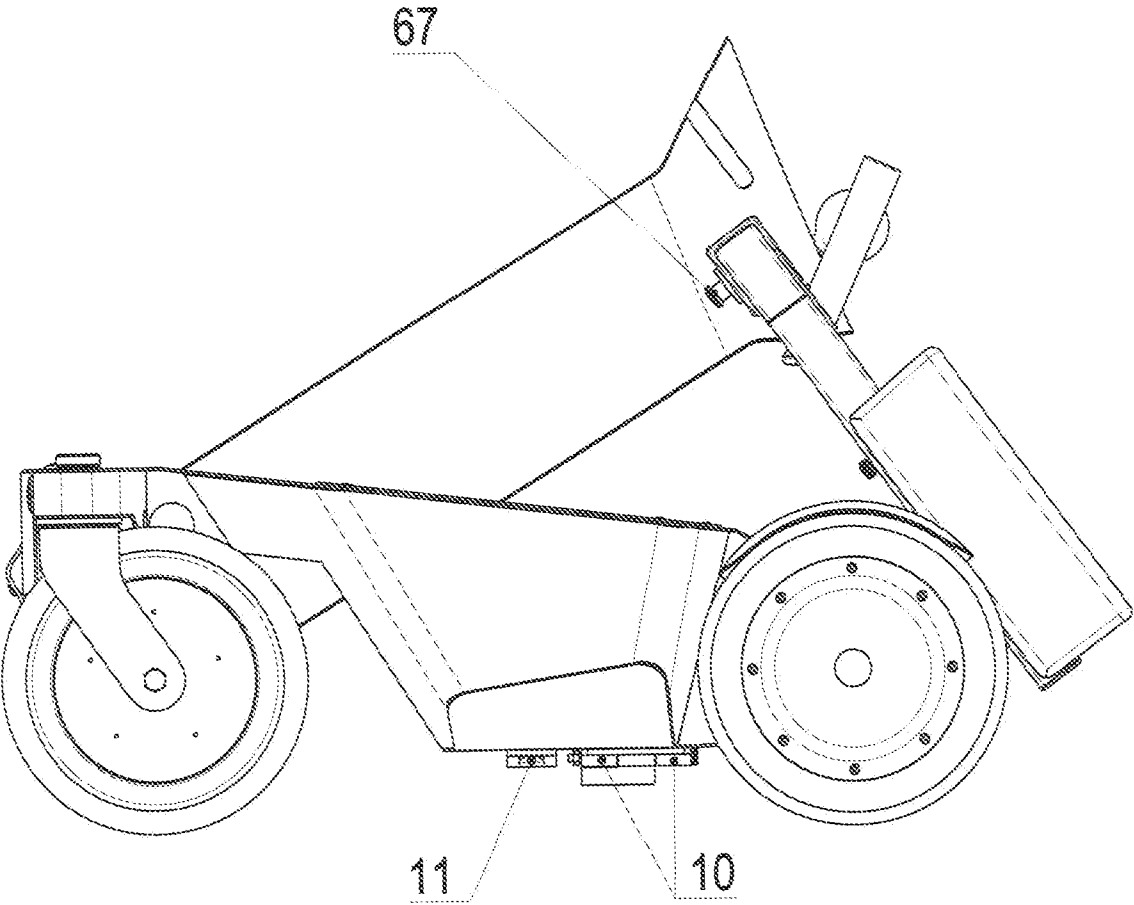


FIG.6

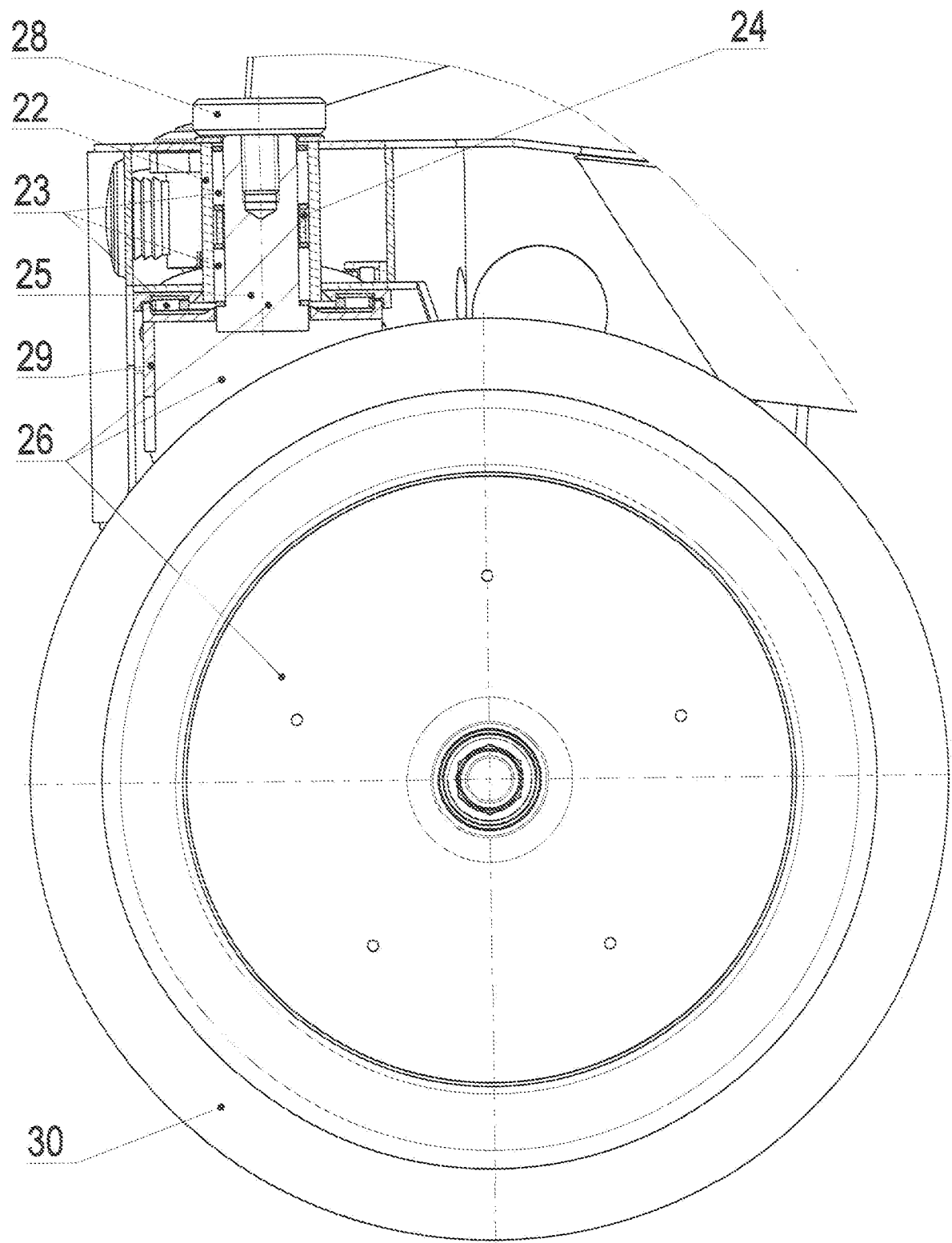


FIG.7

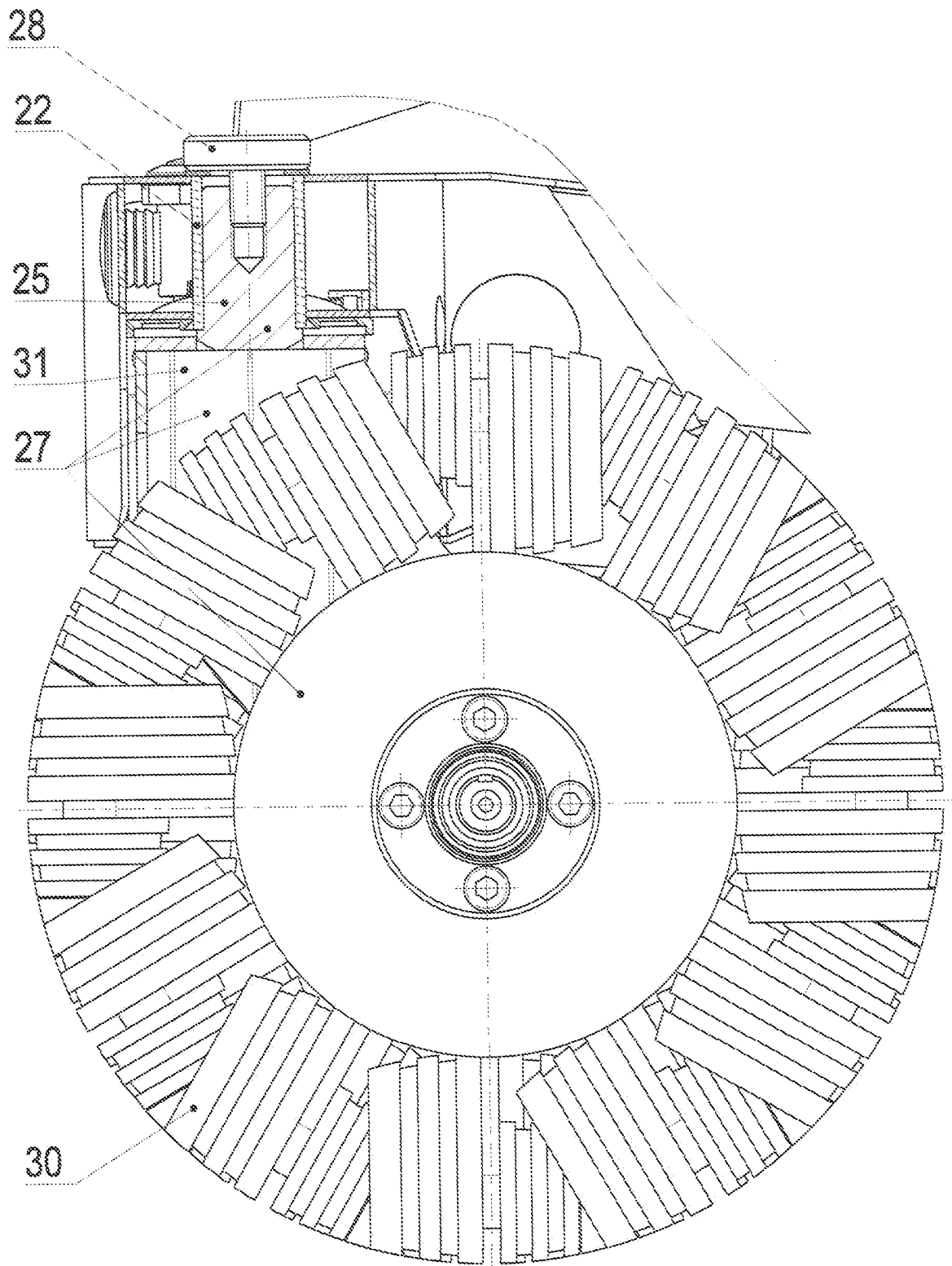


FIG. 8

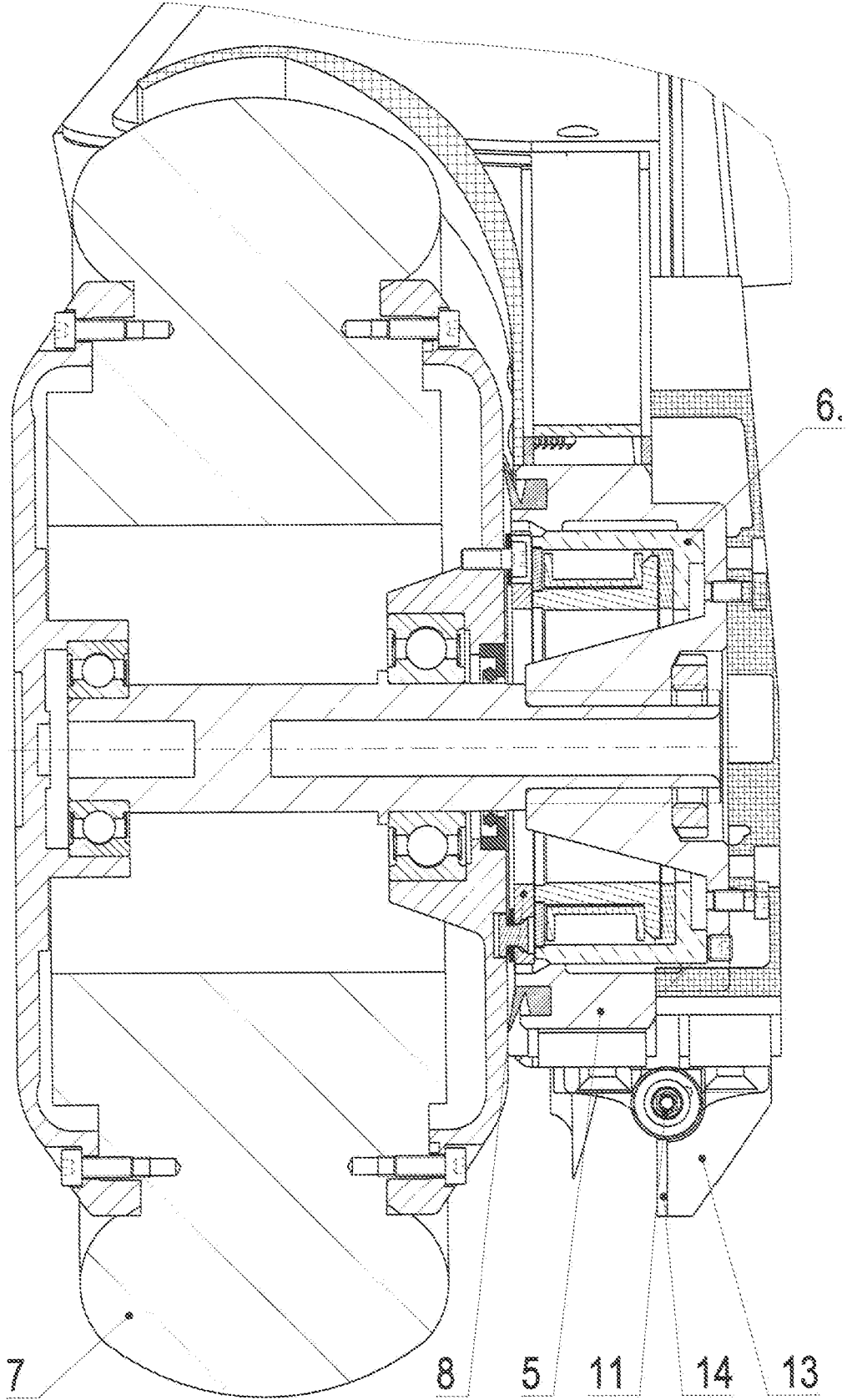


FIG.9

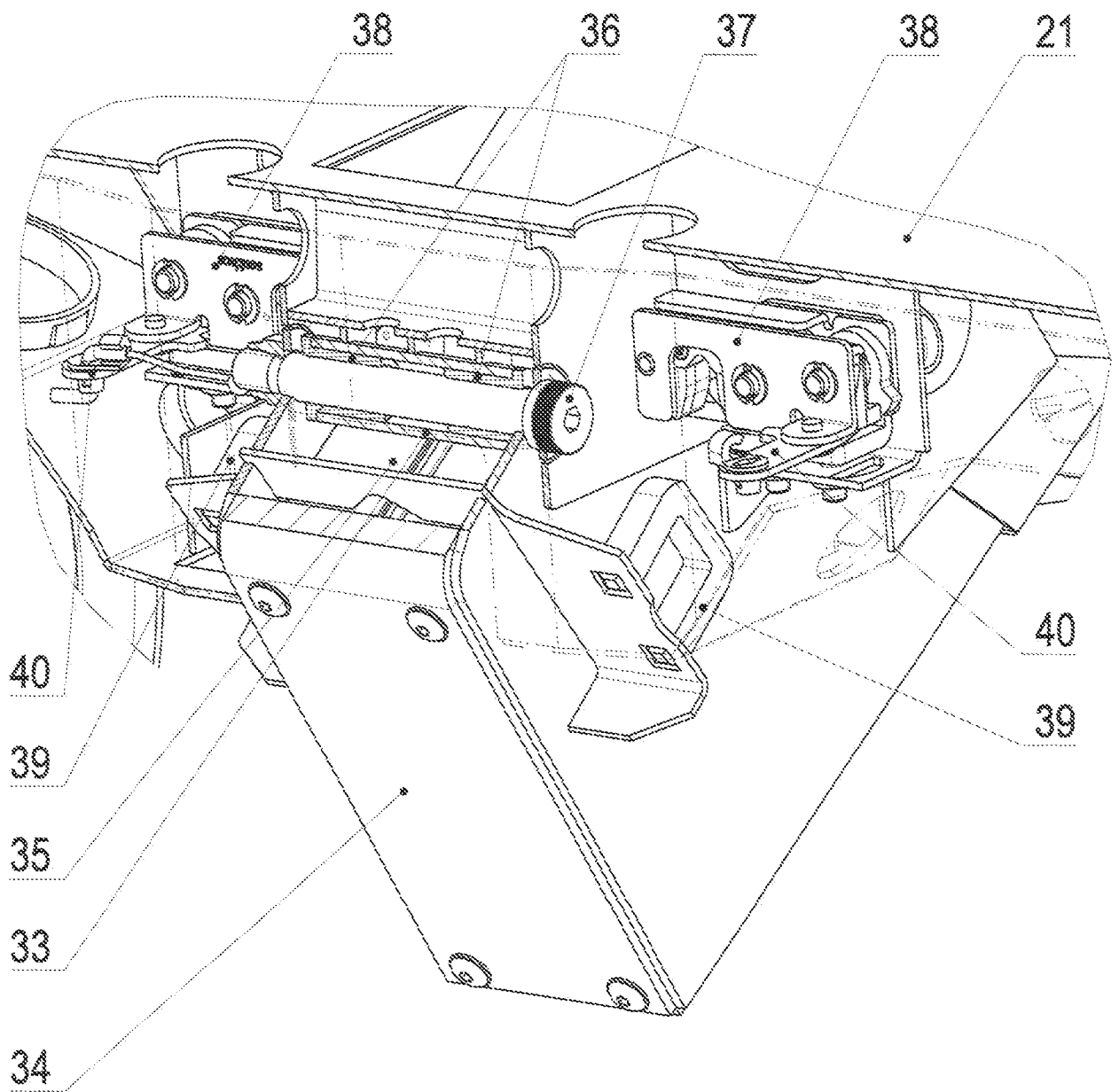


FIG.10

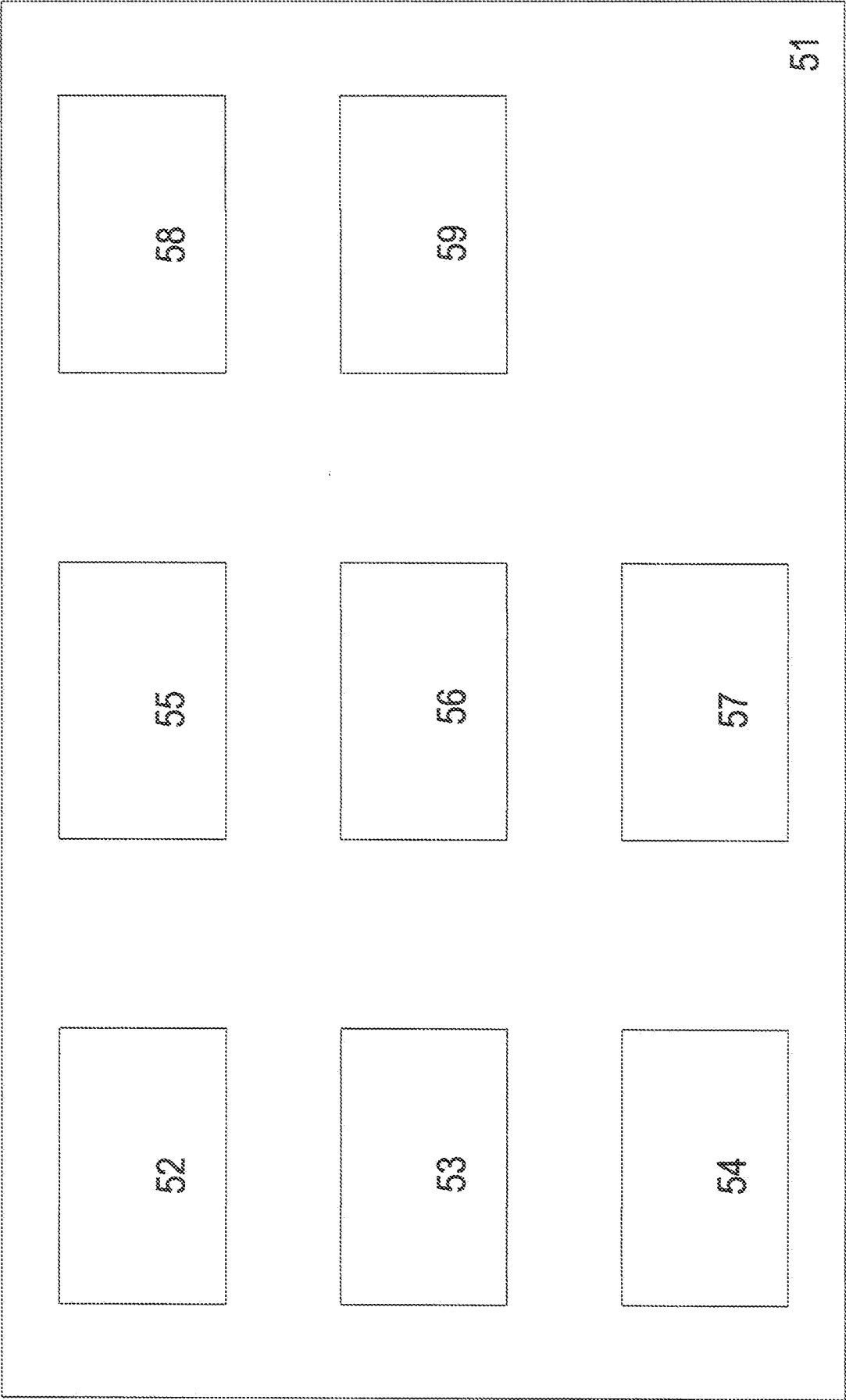


FIG.11

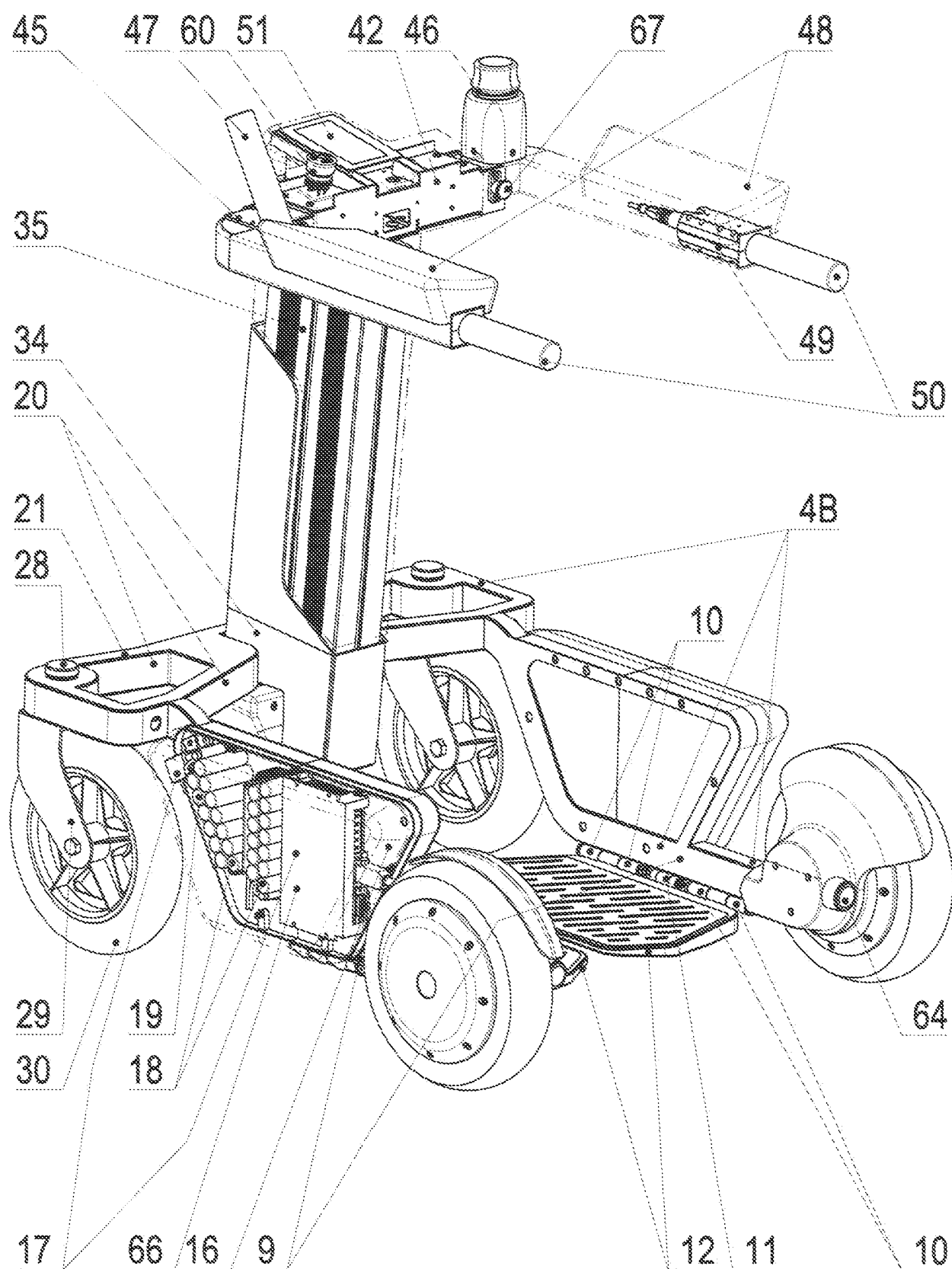


FIG. 12

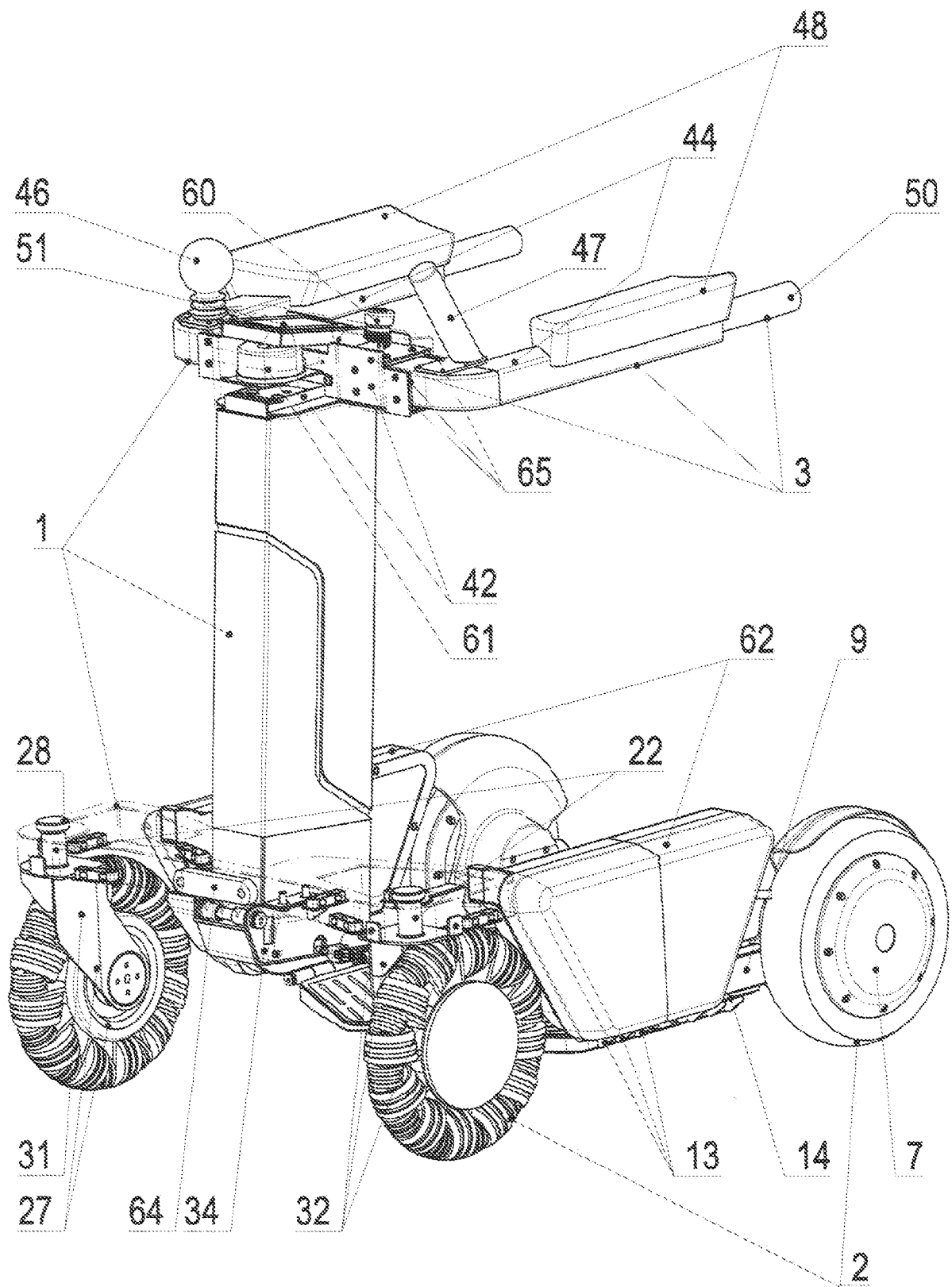


FIG.13

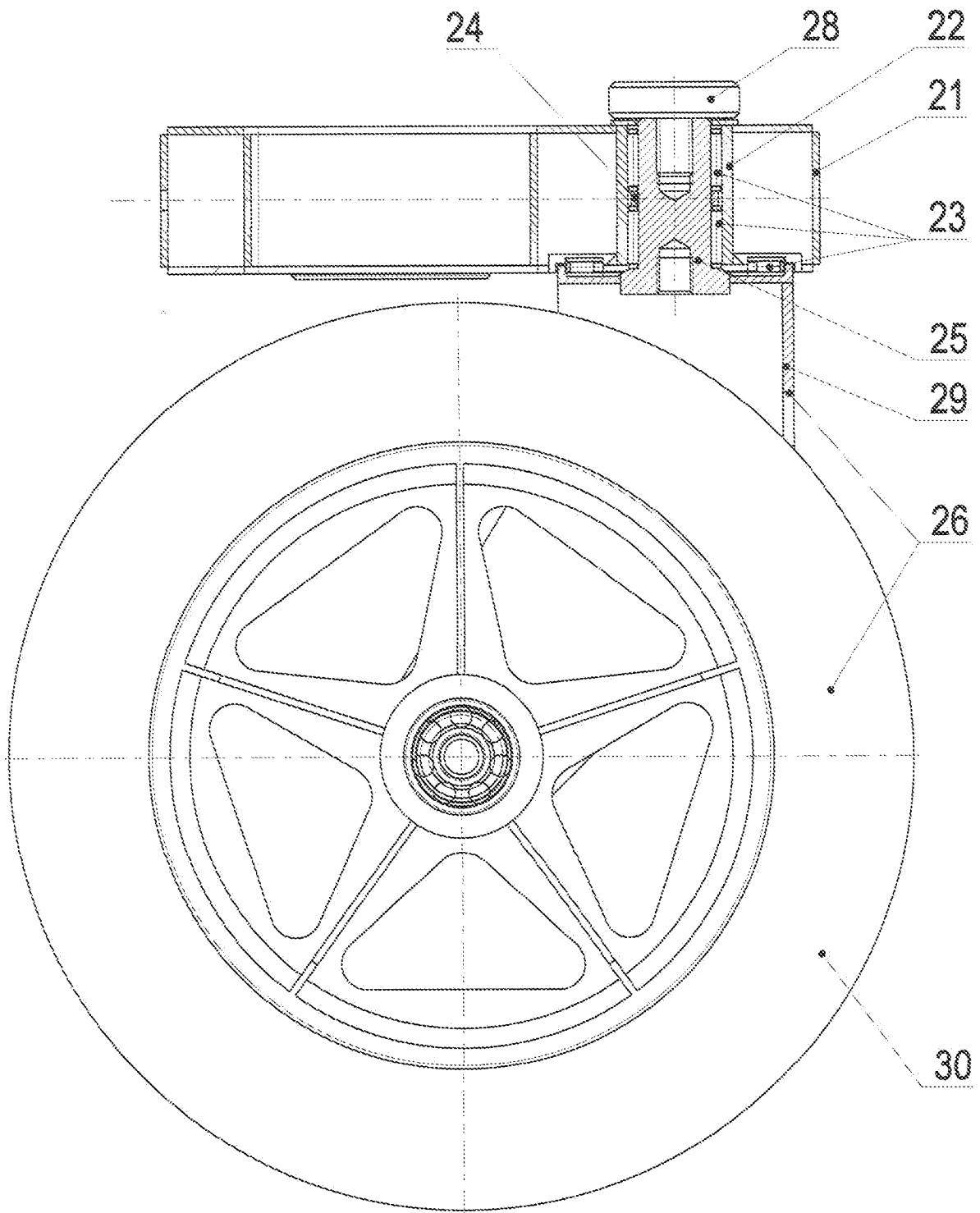


FIG.14

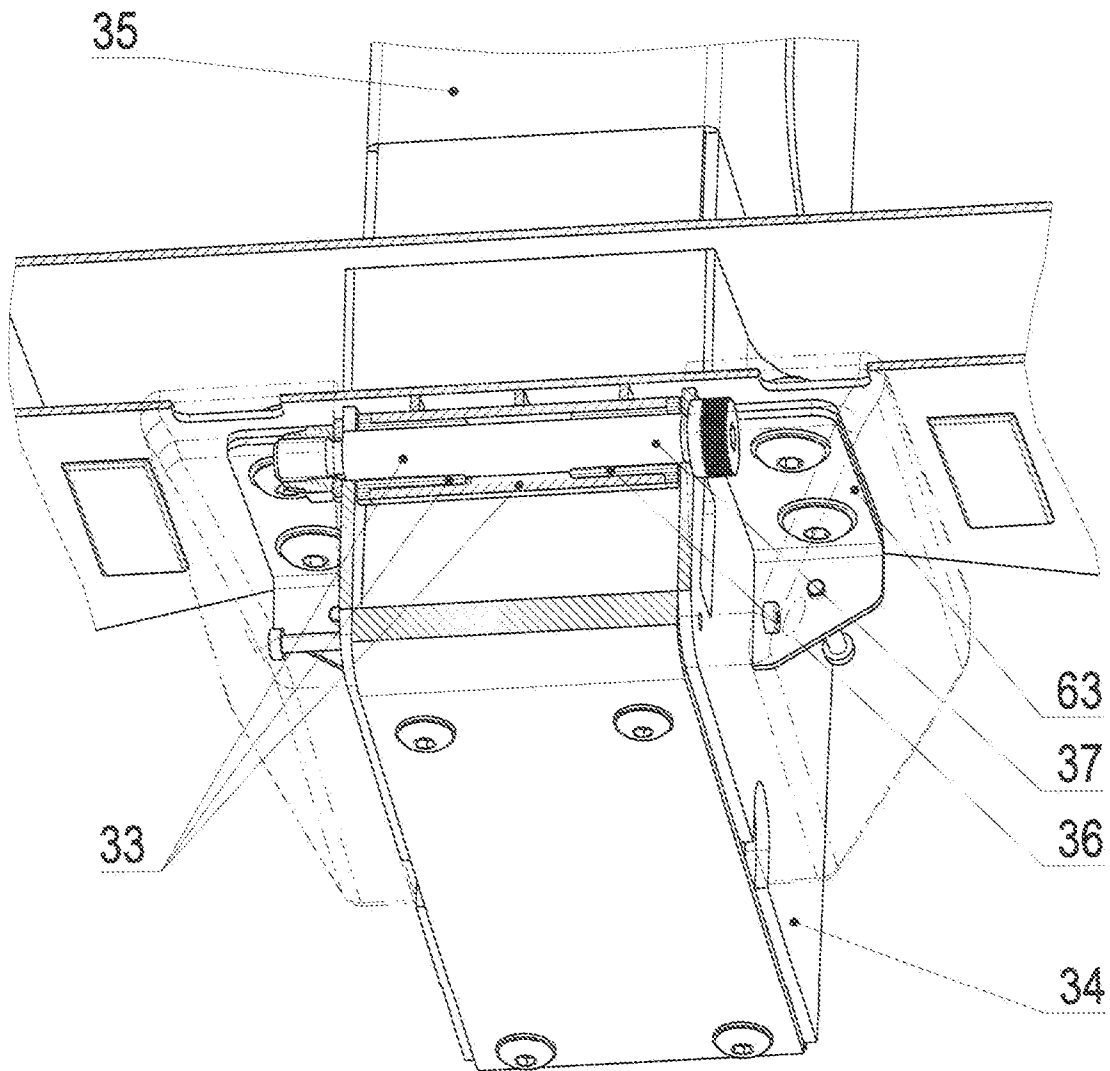


FIG.15

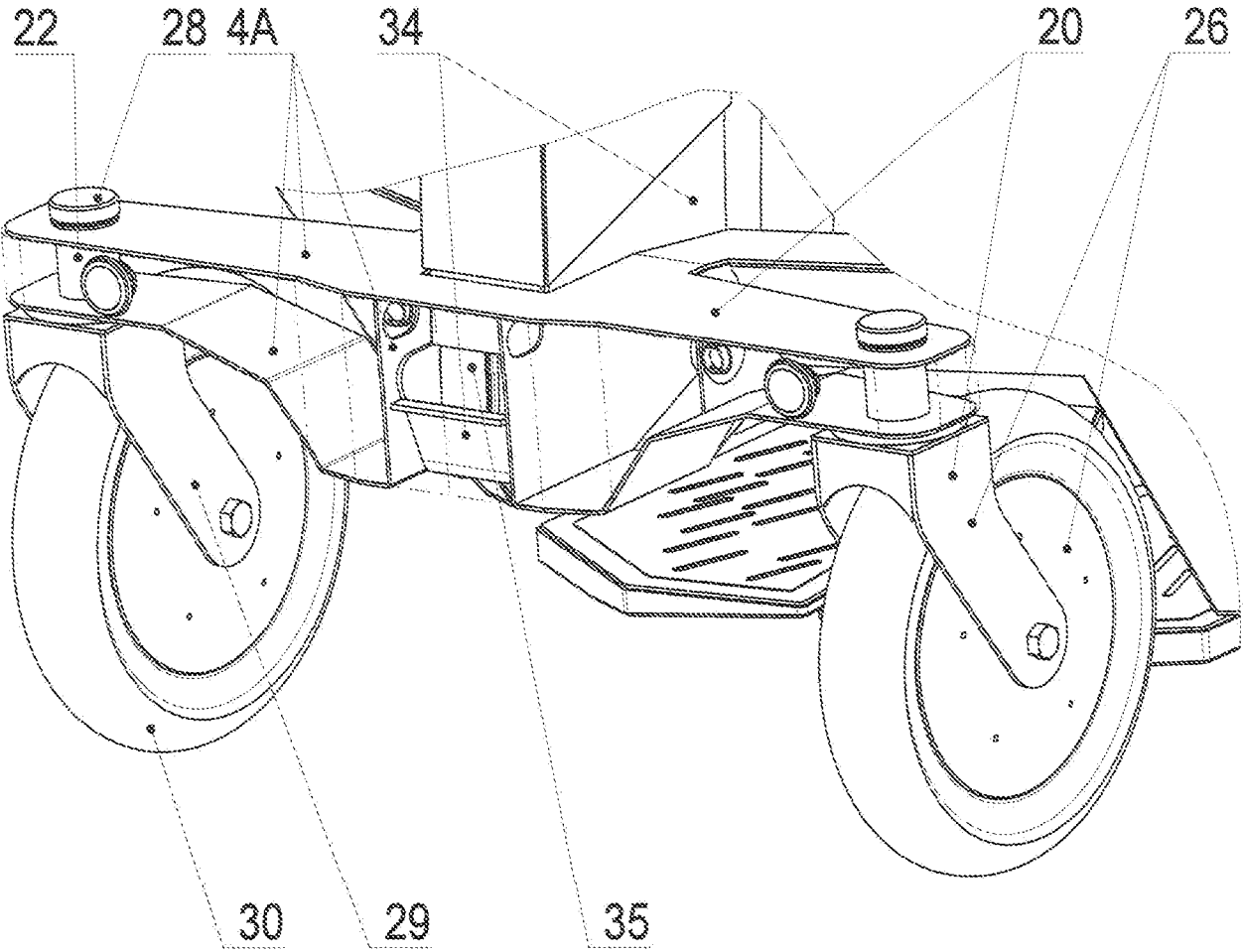


FIG.16

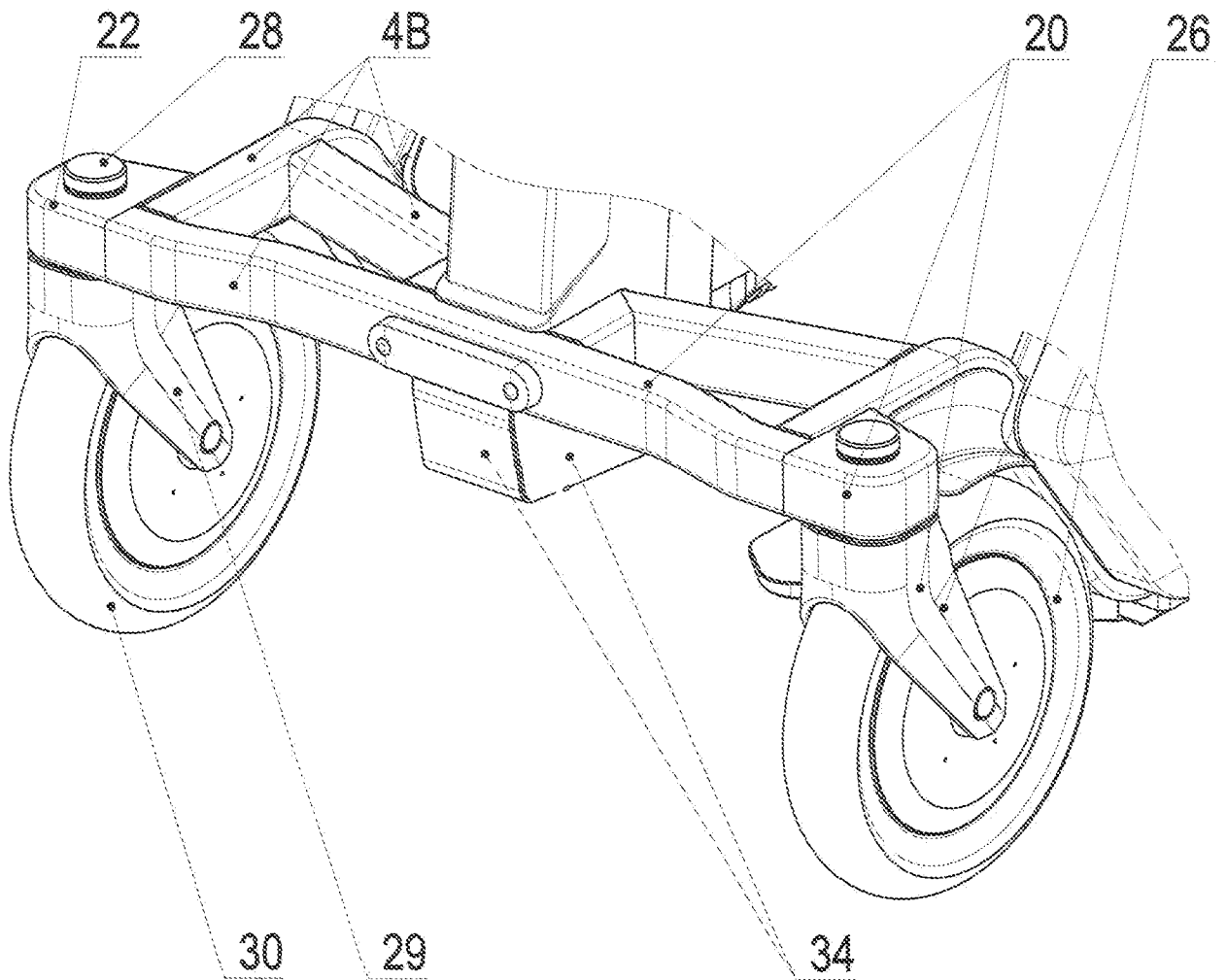


FIG.17

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2024/000014

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61H3/04

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)

A61H B62D A61G

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 3 395 316 A1 (ROBOTSYSTEM S R O [CZ]; HALADOVA PETRA [CZ]) 31 October 2018 (2018-10-31) paragraphs [0009] - [0028]; figures 1-3 -----	1-3, 7-9, 14-23
Y	US 2019/365592 A1 (NORTON JOHN MARK [US] ET AL) 5 December 2019 (2019-12-05) paragraphs [0100] - [0103]; claims 1-23; figures 1-9 -----	1-3, 7-9, 14-23
Y	JP 2008 237594 A (TAKANO CO LTD) 9 October 2008 (2008-10-09) claims; figures -----	1-3, 7-9, 14-23
Y	WO 2022/224238 A1 (GOLFIT LTD [IL]) 27 October 2022 (2022-10-27) claims; figures ----- - / - -	1-3, 7-9, 14-23



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search

16 August 2024

Date of mailing of the international search report

31/10/2024

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Fax: (+31-70) 340-3016

Authorized officer

Shmonin, Vladimir

INTERNATIONAL SEARCH REPORT

International application No

PCT/CZ2024/000014

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2009 247411 A (SOAI KK) 29 October 2009 (2009-10-29) claims; figures -----	1-3, 7-9, 14-23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CZ2024/000014

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims;; it is covered by claims Nos.:
2, 3, 7-9, 14-23 (completely); 1 (partially)

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 2, 3, 7-9, 14-23(completely); 1(partially)

a robotic walker with a shell frame, bearing, locks,
pivotally mounted footboard, wiring, sensors, handles,
interface

2. claims: 4(completely); 1(partially)

a robotic walker with transverse cylindrical flanges,
overhung ends, electromagnetic brake stators, inner cover,
the brake blade

3. claims: 5, 6, 10-13(completely); 1(partially)

a robotic walker with freely rotatable / omnidirectional
wheel units, front axle, vertical housing, vertical pin

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/CZ2024/000014

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 3395316	A1	31-10-2018	CZ 309495 B6 EP 3395316 A1	01-03-2023 31-10-2018
US 2019365592	A1	05-12-2019	US 2019365592 A1 WO 2019236627 A1	05-12-2019 12-12-2019
JP 2008237594	A	09-10-2008	JP 4885026 B2 JP 2008237594 A	29-02-2012 09-10-2008
WO 2022224238	A1	27-10-2022	TW 202300374 A WO 2022224238 A1	01-01-2023 27-10-2022
JP 2009247411	A	29-10-2009	JP 5071670 B2 JP 2009247411 A	14-11-2012 29-10-2009