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(54) MULTIFUNCTIONAL TRANSPORT AND REHABILITATION ROBOT

(57) Multifunctional transport and rehabilitation robot (1) comprises of a vertically adjustable U-frame (2) which is telescopically mounted in the sides (3) when an actuator (15) of a U-frame is placed in the side frames (17), while in the vertically adjustable U-frame (2) through a synchronization double-lever (26) and an axial seat composition (5) is placed a seat (4) which comprises of a seat pad (6), a backrest (7) and a headrest (8), while the seat pad (6) and backrest (7) are mutually connected by the axial composition (5) of the seat , where the headrest (8) is pivotally mounted against the backrest (7) through an axial composition (9) of the headrest, while the seat (4) is equipped with a seat parallelogram (25), while in the longitudinal arms of the vertically adjustable U-frame (2), the height adjustable armrests (10) are mounted, which are part of the parallelogram (11) of the armrests, while the footrests (31) and omnidirectional wheels (16), each of which in-wheel electric motor (18), are placed in the sides (3), while the sides (3) are fitted with a frame (17) and the cover (19) of the sides.

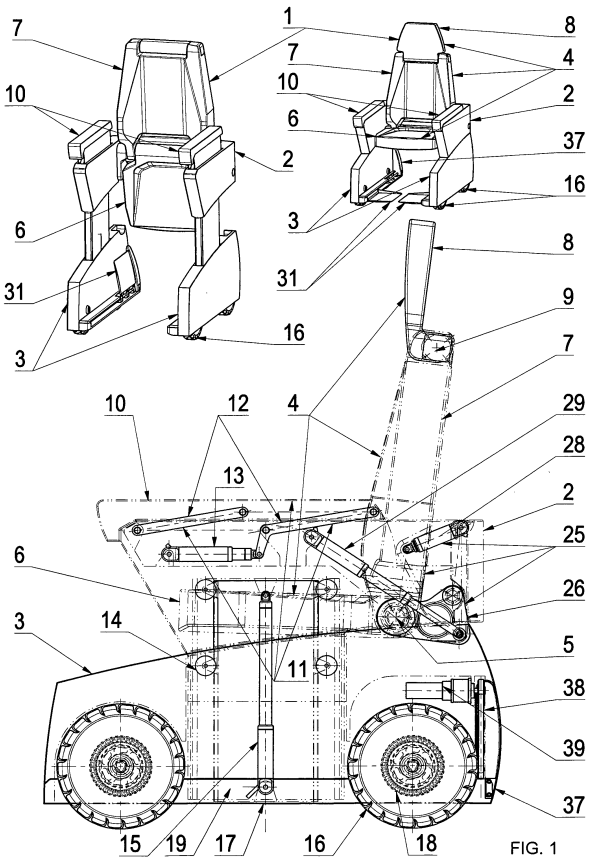

FIG. 1

EP 3 072 489 A1

Description

TECHNICAL FIELD

[0001] The invention relates to a robotic device designed for transport and rehabilitation of physically handicapped persons, combining the option of walking with support, riding in a standing position, and riding in a sitting position.

DESCRIPTION OF THE PRIOR ART

[0002] Currently, there is a wide range of devices on the market, that are aimed at increasing the mobility of disabled persons or their rehabilitation in order to enhance or restore their walk motor skills, and that are designed for both home and institutional use. World renowned companies produce transport and rehabilitation devices with design and purpose that are in some parameters close to the proposed robotic system. None of these devices associates vastly different functions of device for rehabilitation of lower limbs through walk with support, transport platform for transport in standing position and movable powered chair with omnidirectional movement, complemented with robotic functions in such a way to allow the user to use and operate it alone without the help of other persons.

[0003] The above mentioned devices can be divided into the following groups:

1) Rehabilitation tools (devices)

[0004] This especially includes the Powered mobile lifting, gait training and omnidirectional rolling apparatus (see US 7938756 B2) that is based on a platform with omnidirectional wheels and that is used almost exclusively for the rehabilitation of people who lost the walk motor function. The apparatus comprises a base with omnidirectional wheels and a harness which provides stability of the rehabilitated person in the upright position and generates the characteristic movements of walking.

[0005] Those mechanisms allow the user to enter the robotic device from sitting position, to walk and get out completely separately. The apparatus is also equipped with a peripheral U-shaped frame to provide enough space for walking, and with monitoring and sensor system to evaluate the rehabilitation process.

[0006] The disadvantage of the Powered mobile lifting, gait training and omnidirectional rolling apparatus is particularly its single-purpose while it allows only a standing position. In terms of functionality provided, it allows only assisted entrance, walk with support of powered mechanisms and exit. It does not use any mechanisms that allows transport of users in sitting or standing position or mechanisms that allow sitting on the device.

[0007] A significant disadvantage of these devices is that in general they are intended solely for the rehabilitation processes. They do not allow to be used in the home environment in the normal course of daily routine. Their user also depends mostly on help of other people as skilled operators.

2) Intelligent transport devices

[0008] There are transport devices in various modifications that typically increase the mobility of disabled people and are thus complementary devices to conventional non-powered, but also to some motorized wheelchairs. As an example, there is a transport device NIZUKU (http://www.aizuk.jp/?page_id=199), or TEK RMD (http://www.matiarobotics.com/index.html).

[0009] These devices are intended to be used in the home environment and their typical feature is the ability of standing verticalization, enabling ride in standing and sitting position.

[0010] Another concrete example is the solution of a trolley which is the subject of the invention US 8,459,610 B2. It is a device on which the user moves in a sitting or standing position. The trolley is equipped with a mechanism that connects the seat with adjustable handle and synchronizes their relative motion.

[0011] The disadvantage of the above mentioned systems is primarily the fact that they have a simple chassis which limits their maneuverability in narrow spaces. In addition, the design of the chassis completely eliminates the possibility of user's walk with support.

3) Better equipped wheelchairs

[0012] These are especially higher ranges of quite widely widespread motorized wheelchairs which are equipped with the function of standing verticalization. For example, there are the electric verticalization wheelchairs Xeno by Otto Bock or Permobil C500.

[0013] An important disadvantage of the device of the second and third group is the fact that they allow the users only passive motion. User can be vertically placed to the standing position but he/she cannot perform any physical activity of lower limbs. The user can be only carried. They are means of transportation, which the user can use within normal daily activities, but not for rehabilitation.

The disadvantages of currently used devices can be briefly summarized as follows:

[0014]

- Devices which enable rehabilitation of walk are usually not intended for domestic use and require the cooperation of other people as skilled operators.
- Devices which are intended for domestic use provide only transport or positioning functions.
- Devices do not associate functions of means for rehabilitation of lower limbs through walking with support, transport platform for the transport in standing

position, and mobile powered chair with omnidirectional movement, complemented with robotic functions in such a way to allow the user to use and operate it alone without the help of other persons.

SUMMARY OF THE INVENTION

[0015] The above mentioned disadvantages are largely solved by the Multifunctional transport and rehabilitation robot which vertically adjustable U-frame is placed retractably in the sides and the U-frame actuator is placed in the frames of the sides, while in vertically adjustable U-frame through synchronization double-lever and axial seat composition a seat is placed, which consists of a seat pad, a backrest and a headrest, while the seat pad and backrest are mutually connected through an axial composition of the seat, where the headrest is pivotally mounted against the backrest through axial headrest composition, while the seat is equipped with a seat parallelogram, while in the longitudinal arms of the vertically adjustable U-frame the height adjustable armrests are mounted, which are part of the armrests' parallelogram, while the wheels and footrests are placed in the sides.

[0016] Furthermore, it is advantageous when the vertically adjustable U-frame is mounted in sides by rolling rollers, wherein the sides are fitted with the side frame and side cover.

[0017] Furthermore, it is advantageous when the axial composition of the seat comprises of the linear actuator of a seat pad axially mounted in the central part of the seat pad, attached by a pin in a pin with a flange, while its flange part is used for firm connection with the seat pad, while in the opposite part of the seat pad there is grooving with slotted screw connected by a pin to the sliding part of the linear actuator of the seat, while its helix extends into the eye of the backrest, where the motion nut with a flange is placed, which is firmly fixed in the backrest through a pin, while a pin with a flange mounted in the housing with a flange, firmly imbedded in the eye of the backrest extends to the opposite eye of the backrest.

[0018] Furthermore, it is advantageous when the axial composition of the headrest is formed by axially mounted linear actuator of the headrest in the middle part of the headrest, when the body of the linear actuator of the headrest is mounted through a pin in a pin with a flange, while it is rigidly connected to the headrest through this pin with a flange, and with the retractable side of the linear actuator, through a pin a slotted screw is connected which is stored in the grooving of the headrest, where the motion nut with a flange is mounted, which is through flange firmly imbedded in the backrest, while a pin with a flange expands to the opposite eye of the backrest, pivotally mounted in the housing with a flange, firmly imbedded in the eye of the backrest.

[0019] Furthermore, it is advantageous when there is a synchronization double-lever as a part of the seat parallelogram, forming together with a connecting pipe one of its arms, while its second arm are two linear backrest actuators all mounted in the vertically adjustable U-frame, while their connecting part is the backrest, when the synchronization double-lever is mutually connected to each pin with a retractable part of the linear double-lever actuator so that its opposite side is pivotally placed in the vertically adjustable U-frame.

[0020] Furthermore, it is advantageous when the height adjustable armrests are part of the armrest parallelogram formed by handles connected with the armrest, wherein each of the handles is connected to the retractable part of the linear armrest actuator and its opposite part is through a pin connected to the vertically adjustable U-frame. Furthermore, it is advantageous when there are two omnidirectional wheels placed in each side through solid connection, while each wheel is fitted with an electric motor in its interior.

[0021] Furthermore, it is advantageous when the footrests are mounted replaceably and rotatably in the sides, while their part is a motion screw through a motion nut of the footrest at both ends rotatably mounted in the radiaxial bearings firmly attached to the side frame, when there is a bumper firmly connected with each side frame in the rear part, while a part of each footrest are support rollers leaning on the area of a guiding rail, while in the rear part of the motion screw in the vicinity of the radiaxial bearing there is a countershaft transmission which includes an output shaft of the rotary actuator. Furthermore, it is advantageous when the armrest actuator, U-frame actuator, headrest actuator, backrest actuator, double-lever actuator and seat pad actuator are rotary actuators with transmission.

[0022] A significant advantage of the proposed device is that it combines the function of a means for rehabilitation of lower limbs through walk with support, while offering the option of electronically controlled omnidirectional movement and height adjustable armrests, function of transport electric platform with electronically controlled transport of the patient in standing position, and function of mobile powered chair with omnidirectional movement. The system also allows the complete positioning including comfortable seat headrests.

[0023] The proposed solution combines advantageously function of a rehabilitation device with verticalization wheelchair, and adds unlimited maneuverability of a chassis with omnidirectional wheels, while the user can use it without the help of others.

Description of Drawings

[0024] The attached sheets show figures and legend.

[0025] The figure for annotation shows the axonometric views of two basic user positions of device at the top; position for walking is depicted in the upper left corner; position intended for sitting is depicted in the upper right corner. Rectangular view of the device from the side is depicted at the bottom.

FIG. 1 illustrates axonometric views of two basic user positions of the device; position for walking is depicted in the upper left corner; position intended for sitting is depicted in the upper right corner. A rectangular view of the device from the side is depicted at the bottom.

FIG. 2 illustrates a rear axonometric view of the device as a whole in the lower part of the figure; detail of the seat parallelogram and storage of the synchronization double-lever in vertically adjustable U-frame in the upper part of the figure.

FIG. 3 illustrates cuts of the omnidirectional wheels with in-wheel electric motor, footrest, motion screw and countershaft transfer situating - detailed views.

FIG. 4 illustrates cuts of the headrest, axial seat composition and pull-out guide surfaces of the vertically adjustable U-frame - detailed views.

An example of the invention version

[0026] Multifunctional transport and rehabilitation robot 1 includes the vertically adjustable U-frame 2 which is through roller pulleys 14 telescopically mounted in two sides 3 with omnidirectional wheels 16, where pins of roller pulleys 14 are stored directly in the sides 3 with omnidirectional wheels 16, and guiding surfaces of roller pulleys 14 are part of the vertically adjustable U-frame 2, while the roller pulleys 14 are connected with the frame 17 of the sides that are fitted with retractable guiding surfaces of the vertically adjustable U-frame 2,

while in each frame 17 of the sides, a linear actuator 15 of the U-frame is placed, which is mounted at the bottom of the side 3 with omnidirectional wheels 16, and in the guide part of the vertically adjustable U-frame 2 at the opposite end;

while in the vertically adjustable U-frame 2 through the synchronization double-lever 26 and axial composition of the seat 5 a seat 4 is mounted pivotally, which comprises a seat pad 6 and a backrest 7 interconnected with the axial composition of the seat 5 and a headrest 8 which is mounted pivotally to the backrest 7 through the axial composition 9 of the headrest;

while the synchronization double-lever 26 is pivotally mounted in the vertically adjustable U-frame 2 through hollow pins 27 firmly anchored in it and through parts of a motion nut 23 with a flange and housing 24 with a flange it carries the axial seat composition 5, consisting of a linear actuator 30 of the seat axially placed in the central portion of the seat pad 6, which is through bolt mounted to a pin 21 with a flange, which flange part is used for fixed connection to the seat pad 6, while in the opposite part of seat pad 6 gouging is its part to which a slotted screw 22 is mounted through a pin connected with the retractable part of the linear actuator 30 of the seat pad, while a helix already extends into the eye of the backrest 7, where the motion nut 23 with flange is placed, which is through flange firmly fixed in the backrest 7, while the pin 21 with flange in housing 24 with flanges firmly fixed in the eye of the backrest 7, extends to the opposite eye of the backrest 7;

while the synchronization double-lever 26 is a part of a seat paralelogram 25, where the synchronization double-lever 26 with a connecting tube is one arm of the seat parallelogram 25, while its second arm are the two linear actuators 28 of the backrest, all mounted in vertically adjustable U-frame, while their connection part is the backrest 7, where the synchronization double-lever 26 is mutually connected to each pin with a retractable part of the linear actuator 29 of the double-lever that its opposite side is pivotally placed in the vertically adjustable U-frame 2;

while the axial composition 9 of the headrest is in the central part of the headrest 8 by axially mounted linear actuator 20 of the headrest, where the body of the linear actuator 20 of the headrest is through a pin mounted in a pin 21 with a flange, while it is through this pin 21 with a flange fixedly connected to the headrest 8 and with a retractable side of the linear actuator 20 of the headrest there is through a pin connected a slotted screw 22 mounted in gouging of the headrest 8, while its helix expands to the eye of the backrest 7, where the motion nut 23 with flange is placed, which firmly imbedded in the backrest 7 through a flange, while a pin 21 with flange, pivotally mounted in the housing 24 with a flange, firmly imbedded in the eye of the backrest 7, expands to the opposite eye of the backrest 7;

while in the longitudinal arms of the vertically adjustable U-frame 2, height-adjustable armrests 10 are mounted, each as a part of the parallelogram 11 of the armrests, which includes two handles 12 connected with the armrest 10, while each of the handle 12 is connected through a pin with a retractable part of the linear actuator of the armrests 13 a its opposite side is through a pin connected with the vertically adjustable U-frame 2;

while in each side 3, two omnidirectional wheels 16 are mounted lightly through fixed shaped connection; each with in-wheel electric motor 18, while outside the side 3, a side cover 19 is placed, while a bumper 37 is connected with each side frame 17 in the rear part;

while in sides 3, a pair of footrest 31 is placed in sides slidably and rotatably, having motion screw 32 passing motion nut 33 of the footrest on both sides rotatably mounted in radiaxial bearings 34, firmly connected with the side frame 17, while support rollers 35 leaning on the area of the guiding rails 36 are part of each footrest 31, while in the rear part of the motion screw 32 near the radiaxial bearing 34, countershaft transfer 38 is mounted, having an output shaft of a rotary actuator 39.

Functions

[0027] Multifunctional transport and rehabilitation robot 1 is designed as a support device for the physically limited users, allowing entrance without the assistance

of another person a combining the functions of walking with support and transport with the possibility of driving in standing and sitting positions, all with the possibility of omnidirectional movement.

[0028] The basic part is a vertically adjustable U-frame 2, placed in the two sides 3, while ejection of the vertically adjustable U-frame 2, as a user-customizable dimension, is enabled by guiding with four pulleys 14 firmly connected with the side frame 17 while the retractable guiding surfaces of the vertically adjustable U-frame 2 fit into the sides.

[0029] Ejection movement of the vertically adjustable U-frame is implemented by a linear actuator 15 of the U-frame which is mounted in each side frame 17, while it is mounted in the bottom part in the side 3, and at the opposite end in the guiding part of the vertically adjustable U-frame 2.

[0030] In the vertically adjustable U-frame 2 through the synchronization double-lever 26 and axial composition of the seat 5, a seat 4 is pivotally mounted, comprising a seat pad 6 and a backrest 7 mutually connected by the axial composition of the seat 5 and headrest 8, which is placed pivotally against the backrest 7 by the axial composition of the headrest 9, where relative positioning of the individual parts of the seat 4 is possible by both axis configurations.

[0031] A headrest 8 is in the highest part of the seat 4, while its swivel motion is allowed by the axial composition 9 of the headrest, where the linear actuator 20 of the headrest is placed in the pivot axis of the headrest 8, which is mounted in a pin 21 with a flange and its flange part is used for a fixed connection with the headrest 8, while on the sliding side of the linear actuator 20 of the headrest there is a slotted screw 22 placed, which is placed in the groovingof the headrest 8, while its part with helix expands to the area of the moving nut 23 with a flange placed firmly in the eye of the backrest 7. On the opposite side, in the second eye of the backrest 7 a housing 24 with a flange is mounted, in which a pin 21 with a flange is pivotally mounted.

[0032] The axial composition of the seat 5 allows movement of the seat pad 6 against the backrest 7, while it is the supporting part of the seat 4, while it consists of the same parts as the axial composition 9 of the headrest, with the only difference that the linear actuator causes movement of the seat pad 30 and the housing with a flange 24 and moving nut 23 with a flange are extended so they expand into the area of eyes of the synchronization double-lever 26, allowing necessary swivel movement, thereby forming a main structural member of the seat 4.

[0033] For axial composition of the seat 5 there is therefore in the central part of the seat pad 6 placed a linear actuator 30 of the seat pad, which is mounted in a pin 21 with a flange, which flange part is used for fixed connection with the seat pad 6. In the opposite part of the seat pad 6, there is a gouging, in which a slotted screw 22 is set, by a pin connected with a retractable part of the linear actuator 30 of the seat pad, while its helix expands to the eye of the backrest 7, in which a motion nut 23 with a flange is placed, through its flange firmly fixed in the backrest 7. A pin 21 with flange, mounted in the housing 24 with a flange, firmly placed in the eye of the backrest, expands to the opposite eye of the backrest 7.

[0034] Forward positioning of the seat 4 with the vertical positioning, when it is required that the seat moves in combined movement, is realized by a seat parallelogram 25, and one of its arms is the synchronization double-lever 26 with connecting pipe, and the second arm are two linear actuators 28 of the backrest, which give the possibility to adjust the angle of the backrest 7 and thus provide its swivel motion, all mounted in the vertically adjustable U-frame 2, while the synchronization double-lever 26 is pivotally mounted in the vertically adjustable U-frame 2 through hollow pins 27 firmly anchored in it and through parts of the motion nut 23 with flange and housing 24 with flange and carries the axial seat composition 5, while it is powered by a linear actuator 29 of the double-lever, pivotally mounted in the vertically adjustable U-frame 2.

[0035] In the longitudinal arms of the vertically adjustable U-frame 2, there are height adjustable armrests 10 mounted through parallelogram 11 of the armrests, comprising of two handles 12 connected by an armrest 10, while one of them is controlled by a linear actuator 13 of armrests.

[0036] Each of the sides 3 has two omnidirectional wheels 16, which are placed through firm shape connection, each of which is driven by an electric motor 18 mounted in the wheel, while cover 19 of the side is placed on the side 3, while a bumper 37 is in the rear part firmly connected with each side frame 17.

[0037] Just above the ground, in the area of user, there is a pair of footrest 31 as a part of the sides 3 with omnidirectional wheels 16 slidably and rotatably, and their positioning in anteroposterior movement is allowed by a motion screw 32 with large gradient, passing through the motion nut of the footrest 33, mounted in radiaxial bearings 34 on both ends, firmly connected with the side frame 17. Range of the footrest positioning 31 by a motion screw 32 allows to set the footrests 31 into two preferred positions corresponding to user's driving in a sitting or standing position. Part of each footrest 31 are support rollers 35 leaning on the inner part of the U-hollow of the guide rail 36, which lower support surface is in the rear portion is cut so as to allow lifting of each of the pair of footrests 31 by its twisting by about 90 degrees at the end of backward movement when it abuts the bumper 37. The actuator of the motion screw 32 is implemented through the countershaft transfer 38, driven by a rotary drive 39 firmly interconnected with the side frame 17.

[0038] If there is exclusion of the footrest 31 from the space of use needed, it moves with the motion screw 32 to the rear part of the side 3, where it reaches the bumper 37, and if the gradient of the helix of the motion screw 32 is large and oriented accordingly, the footrest 31 turns

up in the final phase of the movement, where it stops due to rotary drive 39 firmly positioned in the side frame 17. The torque from the rotary drive 39 is transferred to motion screw 32 through countershaft transfer 38. For motion screw 32 of the second of footrests pair 31 is valid that it has the same pitch but opposite helix orientation.

Industrial Use

[0039] Multifunctional transport and rehabilitation robot is a device which allows the physically limited users to enter without the assistance of another person, and it combines the functions of walking with support used for rehabilitation purposes, and transport with the possibility of riding in standing and sitting positions whith a high maneuverability, which is given by the omnidirectional movement.

[0040] The multifunctional transport and rehabilitation robot is a novel robotic technology, associating diametrically different functions - thus as indicated above, there are features for the gait rehabilitation, person transport in standing position, person transport in sitting position, as well as entering and exiting of the user into a sitting position and back to a standing position; all without an assistant. The universality of the robot is also built on the possibility of its use not only for physically handicapped persons who require controlled gait rehabilitation and simultaneously transport in different positions, but even for users with less physical fund requiring a combination of walking with support and riding in the sitting and standing positions. The proposed system is therefore useful, for example, for the elderly, physically disabled persons, persons undergoing treatment and rehabilitation processes, etc.

[0041] High industrial applicability of the robot is given by a wide spectrum of its associated, diametrically different functions into a single robotic device which can thus be applied in various types of medical facilities, rehabilitation in a classic domestic interior environment, but also in outdoor environments.

[0042] Individual subsystems of the transport rehabilitation robot are separately available for other analogous devices in different spheres.

List of the Positions Used

[0043]

1) multifunctional rehabilitation and transport robot
2) vertically adjustable U-frame
3) side
4) seat
5) axial composition of the seat
6) seat pad
7) backrest
8) headrest
9) axial composition of headrest
10) armrest
11) armrest parallelogram
12) handle
13) armrest actuator
14) pulley
15) U-frame actuator
16) omnidirectional wheel
17) side frame
18) electric motor
19) side cover
20) headrest actuator
21) bolt with flange
22) slotted screw
23) motion nut with flange
24) housing with flange
25) seat parallelogram
26) synchronization double-lever
27) hollow pin
28) backrest actuator
29) double-lever actuator
30) seat pad actuator
31) footrest
32) motion screw
33) footrest motion nut
34) radiaxal bearing
35) support roller
36) guide rail
37) bumper
38) countershaft transfer
39) rotary actuator

Claims

1. Multifunctional transport and rehabilitation robot (1) **characterized in that**
the basic construction is a vertically adjustable U-frame (2), which is telescopically mounted in the sides (3), where a U-frame actuator (15) is mounted in the side frames (17), while in the vertically adjustable U-frame (2) through the synchronization double-lever (26) and axial seat composition (5) there is a seat (4) mounted, comprising of a seat pad (6), backrest (7) and headrest (8), while the seat pad (6) and backrest (7) are interconnected by an axial seat composition (5), where the headrest (8) is pivotally mounted against the backrest (7) by the axial composition (9) of the headrest, while the seat (4) is equipped with a seat parallelogram (25), while in the longitudinal arms of the vertically adjustable U-frame (2) there are height adjustable armrests (10) mounted which are part of the parallelogram (11) of the armrest, while wheels (16) and footrests (31) are mounted in the sides.

2. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that**
the vertically adjustable U-frame (2) in the sides (3) is mounted by means of roller pulleys (14), while the

sides (3) are equipped with the side frame (17) and side cover (19).

3. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** an axial seat composition (5) comprises of a linear actuator (30) of a seat pad, axially mounted in the central portion of a seat (6), by a pin mounted in a pin (21) with flange, while the flange part is used for fixed connection to the seat pad (6), while in the opposite part of the seat pad (6) a grooving is its part in which a slotted screw (22) is located, connected with an extendable part of the linear actuator (30) of the seat pad through a pin, while its helix expands to the eye of the backrest (7), in which a motion nut (23) with a flange is mounted, which is firmly mounted in the seat backrest (7) by a flange, while a pin (21) with a flange mounted in a housing (24) with a flange, firmly imbedded in the eye of the backrest (7) expands into the opposite eye of the backrest (7).

4. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** an axial composition (9) of a headrest comprises in the central part of the headrest (8) an axially mounted linear actuator (20) of the headrest, when the body of the linear actuator (20) of the headrest is mounted in a pin (21) with a flange by a pin, when it is through this pin (21) with a flange rigidly connected to the headrest (8) and the retractable part of the linear actuator (20) of the headrest is by a pin connected with a slotted screw (22) which is stored in grooving of the headrest (8), while its helix expands into the eye of the backrest (7), in which a motion nut (23) with a flange is located, which is firmly mounted in the backrest (7) by a flange, while a pin (21) with flange pivotally mounted in a housing (24) with a flange, firmly imbedded in the eye of the backrest (7) expands into the opposite eye of the backrest (7).

5. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** part of the parallelogram (25) of the seat is a synchronization double-lever (26) forming a one of its arms with a connecting tube, while the second arm is formed by the two linear actuators (28) of the backrest, all mounted in a vertically adjustable U-frame (2), while the backrest (7) is the connecting piece, when the synchronizing double-lever (26) is mutually connected with a retractable part of the linear actuator (29) of the double-lever by a pin, and its opposite side is pivotally mounted in the vertically adjustable U-frame (2).

6. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** height adjustable armrests (10) are part of the parallelogram (11) of the armrests formed by the handles (12) interconnected by armrest (10), wherein each one of the handles (12) is connected with the retractable part of the linear actuator of the armrests (13) and its opposite part is connected by a pin to the vertically adjustable U-frame (2)

7. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** in each of the sides (3), two omnidirectional wheels (16) are mounted by fixed shape connection, each with an in-wheel electric motor (18).

8. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** footrests (31) are mounted in the sides (3) slidably and rotatably, while their part is a motion screw (32) passing through a motion nut (33) of the footrest rotatably mounted in radiaxial bearings (34) on both ends, firmly connected with the side frame (17), while a bumper (37) is firmly connected with each side frame (17) in the rear part, while support rollers (35) leaning on the surface of guide rail (36) are parts of each footrest, while a countershaft transfer (38) is mounted in the rear part of the motion screw (32), close to the radiaxial bearing (34), which part is an output shaft of the rotary actuator (39).

9. Multifunctional transport and rehabilitation robot (1) according to the claim 1 **characterized in that** actuator (13) of the armrest, actuator (15) of the U-frame, actuator (20) of the headrest, actuator (28) of the backrest, actuator (29) of the double-lever and actuator (30) of the seat pad are rotary actuators with transmission.

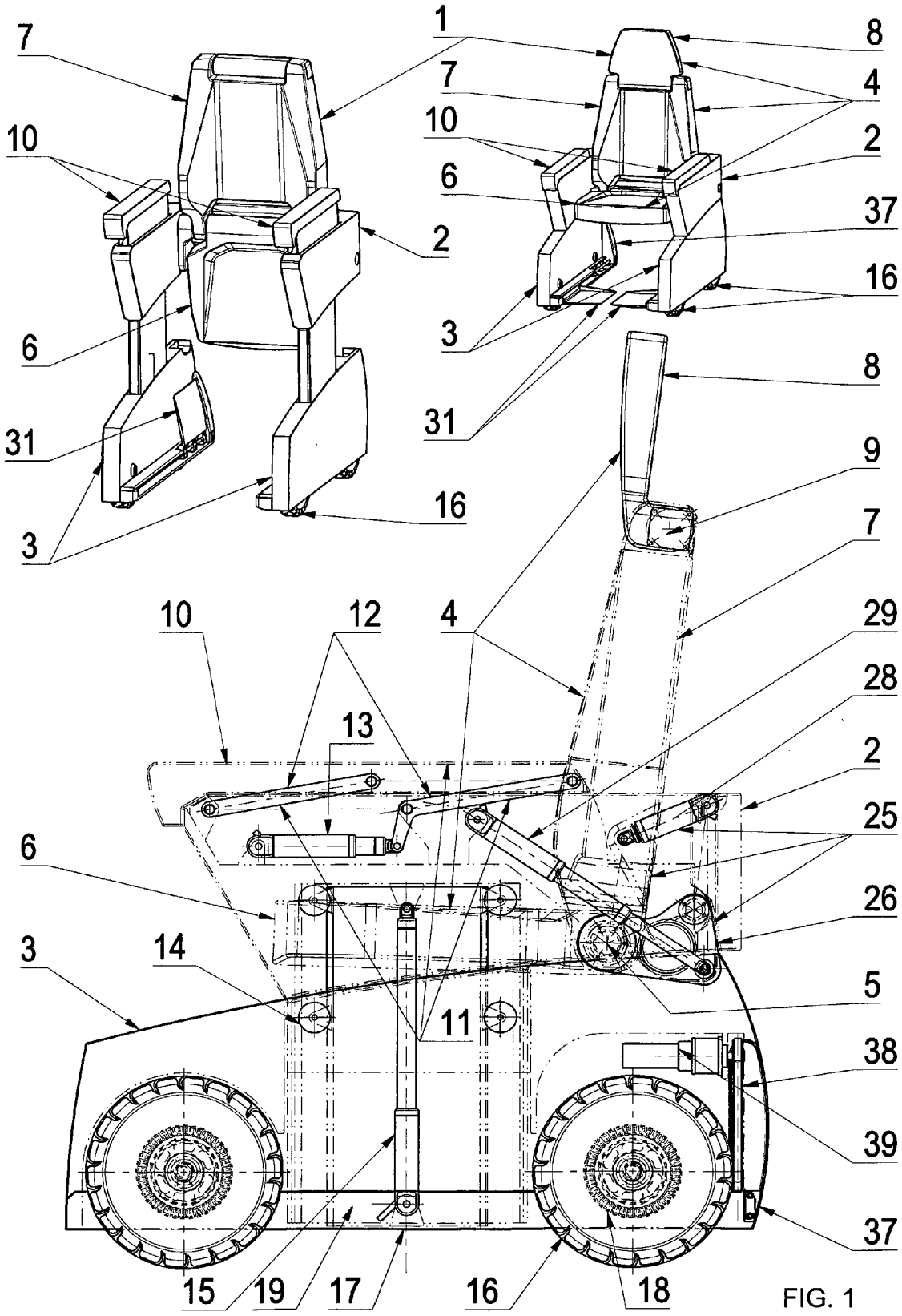
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FIG. 1

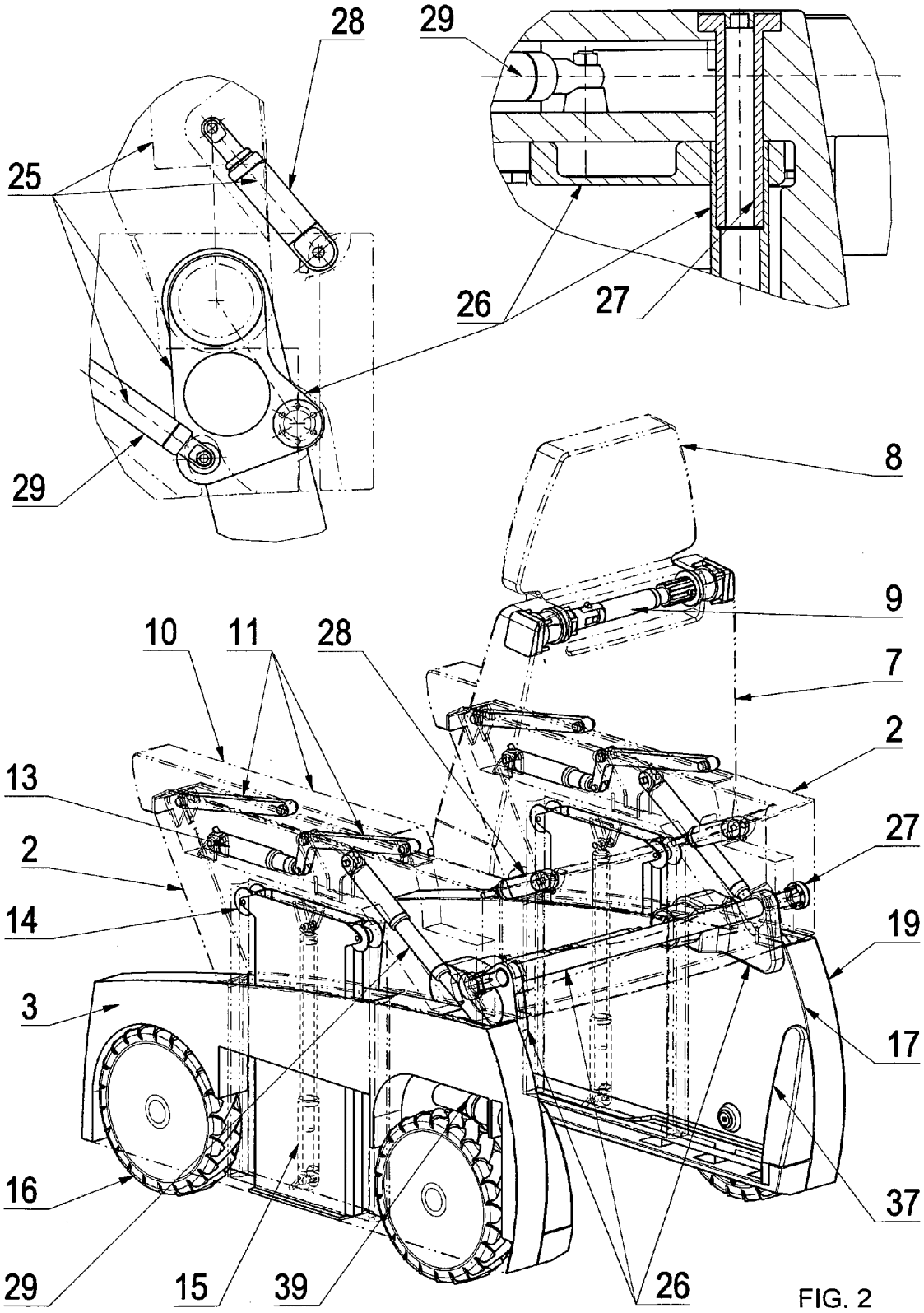

FIG. 2

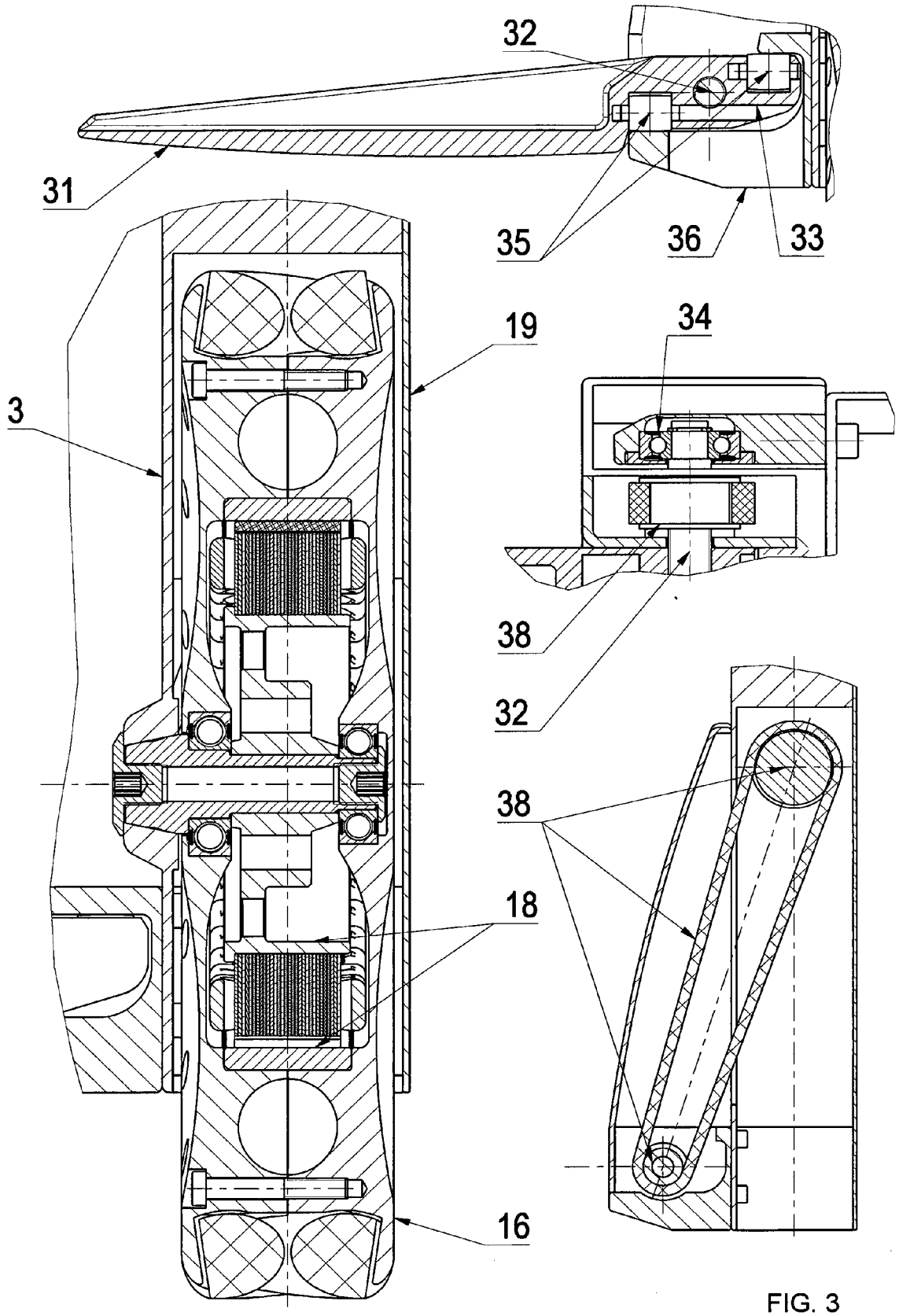

FIG. 3

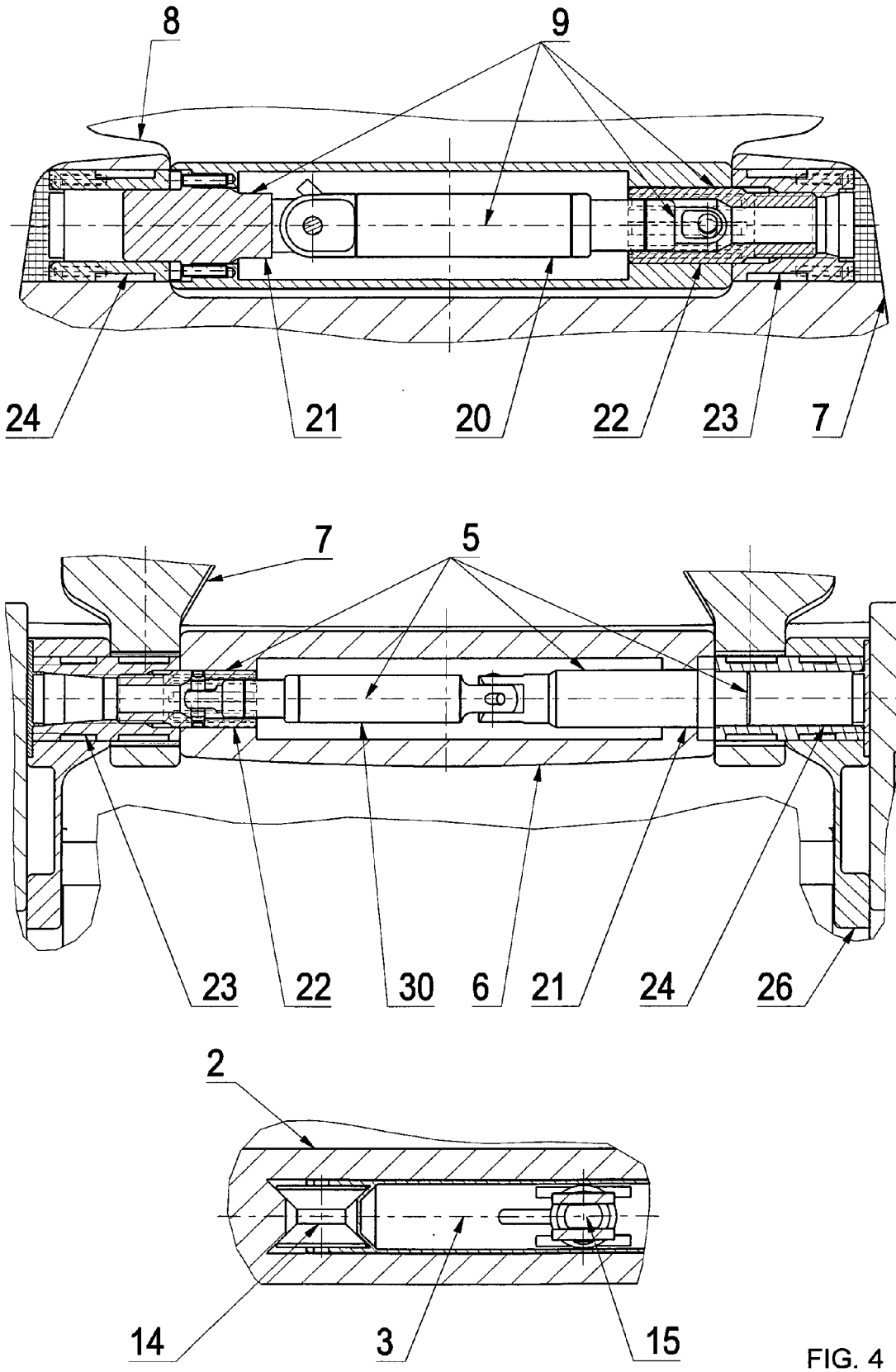

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 15 46 6006

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A61G
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 August 2016	Petzold, Jan

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