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(11) **EP 1 523 969 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.04.2005 Bulletin 2005/16

(51) Int Cl.7: **A61G 5/04, A61G 5/08**

(21) Application number: **04024408.9**

(22) Date of filing: **13.10.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK

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(30) Priority: **13.10.2003 GB 0323901**

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(54) **Propulsion arrangement for personal mobility vehicle**

(57) A powered vehicle for personal mobility, having respective motors for driving respective wheels of the vehicle and respective transmission arrangements providing a driving connection between each motor and its

associated wheel, which connection can be disconnected when required, and a control member operable on the transmission arrangements to disconnect them all by one action.

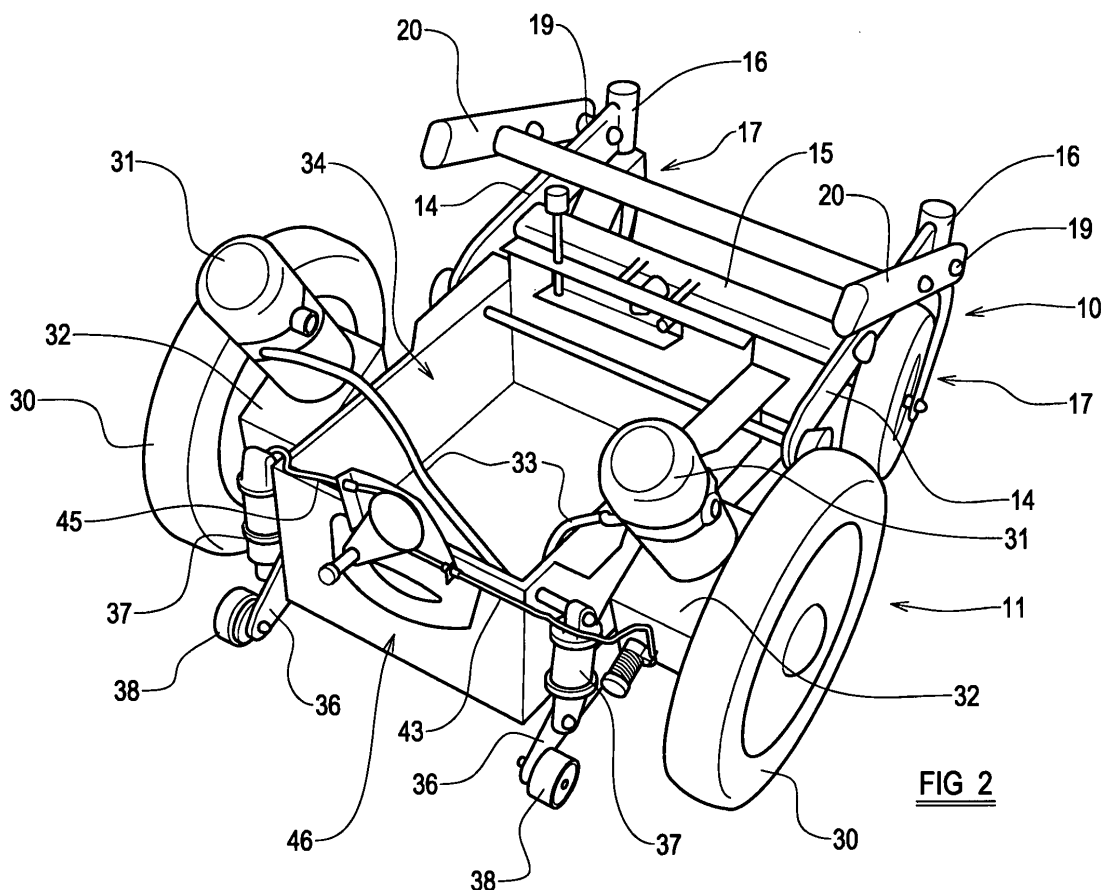


FIG 2

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Description

Description of Invention

[0001] This invention relates to a powered vehicle for providing personal mobility, and more particularly to an aspect of a propulsion arrangement for such a vehicle.

[0002] The type of vehicle in relation to which the invention has been devised is that whose purpose is to carry a person whose mobility is impaired. A specific example of the type of vehicle is a wheelchair, and the invention is described hereafter in relation to a wheelchair, although it is to be appreciated that the invention may be applicable to other such vehicles if they incorporate a similar propulsion system.

[0003] The type of propulsion system to which the invention is applicable is one in which two wheels on opposite of the vehicle from one another are drivable by respective electric motors, there being a control system which is able to control the electric motors so that their respective wheels are driven at different speeds from one another, thereby to steer the vehicle. Such a propulsion system is common on wheelchairs, in which a user who may have very little mobility in his or her limbs is nevertheless able to operate a control device such as a "joystick", thereby to control forwards and rearwards movement and steering of the wheelchair.

[0004] Each electric motor is usually connected to its respective wheel by a gearbox which provides a very high reduction ratio between the motor and wheel. The electric motors may incorporate brakes which "fail safe", i.e. are applied when electrical power is not supplied to the motors. The reduction gearing may incorporate a type of gearing such as a worm drive which has the effect that the wheel cannot readily turn the motor unless the latter is electrically energised, and this together with the provision of a brake as aforesaid means that if, for example, batteries supplying electrical power to drive the wheelchair become discharged, the wheelchair is incapable of being moved on its wheels. This would be inconvenient, and potentially dangerous in certain circumstances. This is the problem addressed by the present invention.

[0005] According to the invention, we provide a powered vehicle for personal mobility, including respective motors for driving respective wheels of the vehicle and respective transmission arrangements providing a driving connection between each motor and its associated wheel, which connection can be disengaged when required, and a control means operable on the transmission arrangements to disengage them all by one action.

[0006] In a vehicle according to the invention, the provision of a control means which is operable on the respective transmission arrangements to disengage them all by one action of the control member means that if the vehicle should be found to be unable to move due to an electrical problem for example, it can quickly and easily be rendered capable of movement on its wheels and

thus pushed or pulled to a place of safety if it had been in a vulnerable position.

[0007] Each of the transmission arrangements, which usually will be a reduction gearbox, may incorporate a clutch device, e.g. a dog clutch for disengaging its driving connection when required.

[0008] The control means may be operable on the transmission arrangements by way of respective control cables of the type generally known, and herein referred to, as Bowden cables, comprising an inner flexible cable element, usually of wire, movable lengthways within a flexible sheath element. Such a cable is capable of transmitting motion and substantial tension forces in the inner cable element between opposite ends thereof, whilst the flexibility of the cable accommodates changes in the relative position of the components between which it is transmitting the force and movement.

[0009] The use of Bowden cables enables the control means, for operating on the transmission arrangements, to be disposed more or less anywhere on the vehicle as may be convenient. Bowden cables of suitable length would of course be utilised. In the particular embodiment of vehicle, which is a wheelchair, described after, the control means is disposed on a drive assembly at the rear of the vehicle, where it is accessible to a person behind the wheelchair, who might wish to disconnect the transmission arrangements and then push the wheelchair, but it is relatively inaccessible to a person occupying the wheelchair. However, sometimes it may be a requirement that the control means should be accessible to a user occupying the wheelchair, and it would be a straightforward modification to position the control means appropriately.

[0010] As an alternative to the use of Bowden cables, a linkage including, inter alia, rods, swivel joints and levers for example could be used to connect the control member to the transmission arrangements.

[0011] The invention will now be described by way of example with reference to the accompanying drawings, of which:

Figure 1 is a diagrammatic side elevation of a vehicle, namely a wheelchair, to which the invention may be applied;

Figure 2 is a perspective view, from above and the rear, of part of the vehicle embodying the invention; Figure 3 is a perspective view of a motor, wheel and transmission arrangement of the wheelchair;

Figure 4 is an illustration of a control member of the vehicle.

[0012] Referring firstly to Figure 1 of the drawings, this shows in side elevation an example of an electrically propelled personal mobility vehicle, namely a wheelchair, in accordance with the invention. It comprises a front frame or chassis part indicated generally at 10 and a drive assembly indicated generally at 11, these main parts being releasably connected together. The frame

part 10 supports a seat indicated in outline at 12, for occupation by a user of the wheelchair.

[0013] In greater detail, with additional reference to Figure 2 of the drawings, the frame or chassis 10 includes first and second main frame members 14 which are provided one at each side of the wheelchair, extending forwardly and rearwardly thereof and parallel or generally parallel to one another. The frame members 14 are connected to one another by transversely extending frame members one of which is indicated at 15. The frame members 14 carry at their front ends respective pivotal supports 16 for front castor wheels 17, enabling the castor wheels to pivot about respective vertical or generally vertical axes. At their rearmost ends, the frame members 14 are arranged to be detachably connected to the drive assembly 11, enabling the wheelchair to be dismantled for storage. The seat assembly 12 is connected to the frame 10 of the wheelchair by link members 20 which are pivotally connected at 19 to the frame members 14, there being means (not shown) for fixing the link members 20 at an appropriate inclination thereby enabling the height of the seat 12 to be adjusted.

[0014] The seat assembly 12 comprises, as is known for a wheelchair seat, a base 21, backrest 22, footrests 23, and armrests 24. A joystick control indicated generally at 25 may be mounted to one of the armrests 24, for controlling the wheelchair.

[0015] The drive assembly 11 comprises laterally spaced drive wheels which are independently drivable by respective electric motors 31 by way of respective transmission arrangements disposed in housings indicated generally at 32. These transmission arrangements include reduction gearing providing a relatively high reduction ratio between the motors and the respective wheels, such reduction gearing including, in this embodiment, worm gearing with each motor axis being perpendicular to the rotational axis of its associated wheel. The transmission arrangements also each include respective clutch device, e.g. a dog clutch or a sliding gear, which is able to be operated to disengage the driving connection between the motor and its associated wheel. Electrical cables 33 are illustrated for supplying electrical power to the motors 31 under the command of the joystick control 25, to control forwards and rearwards movement of the wheelchair and, by differential driving of the motors 31, steering thereof. The motors incorporate brakes which are applied when the motors are not electrically energised.

[0016] The wheels 30, motors 31, and transmission housings 32 are carried by a chassis structure 34 which is in the form of a box which can accommodate one or more rechargeable electrical storage batteries for providing electrical power to the wheelchair. At the front of the chassis structure 34, it is adapted for releasable connection to the front frame structure 10 of the wheelchair. The motors 31 are carried by respective arms 36 which are pivotally connected to the box-like chassis structure 34 adjacent the front end thereof, movement of the arms

36 being controlled by respective spring/damper units 37. At their rearmost ends, the arms 36 carry rear support wheels 38 whose purpose is to assist in prevention of the wheelchair's tipping over rearwardly if an attempt is made to climb an upward slope of too great an inclination, and secondly to support the drive assembly when it is disconnected from the frame part 10 of the wheelchair, in an orientation in which it can readily be connected thereto.

[0017] Figure 3 shows the wheel 30, motor 31, and transmission housing 32 at the right hand side of the wheelchair, mounted to the respective arm 36. The clutch device as above referred to, incorporated in the transmission, is operable by a shaft 40 extending outwardly from the transmission housing. The shaft 40 is angularly movable about its longitudinal axis, and carries a quadrant 41 with which one end of an inner cable element 42 of a Bowden cable assembly engages. The outer sheath 43 of the Bowden cable assembly has its end held by an abutment 44 supported by a bracket extending from the transmission housing 32. A coil spring 45 is disposed on the shaft 40 and reacts against the plate 36, to bias the shaft rotationally to the position corresponding to that in which the clutch device in the transmission is engaged, i.e. a driving connection is established between the motor and wheel. To disconnect the clutch device, the shaft 40 must be moved in the opposite direction to that in which it is biased by the spring 45, and this is effected by tension in the inner cable element 42 engaged with the quadrant 41.

[0018] The motor, wheel and transmission assembly at the opposite side of the wheelchair is similarly provided with a clutch device, and the Bowden cable extending therefrom, whose outer sheath is indicated at 45, extends like the Bowden cable 42, 43 to a control assembly 46 which is fixed to the rear wheel of the box-like chassis structure 34, the control assembly being shown in greater detail in Figure 4.

[0019] The control assembly comprises a backplate 50 which is bolted to the rear wall of the chassis 34 by bolts extending through apertures 51 in the backplate. A control handle 52 is pivotable relative to the backplate about an axis provided by a bolt 53, and is fast with a cable drum 54 concentric with the bolt 53. At its opposite end the handle 52 has a manually graspable knob 55, and the handle is resilient, e.g. of sheet metal, so that a formation (not shown) beneath the knob 55 is engageable with either of respective recesses or apertures as indicated at 56, at the limits of movement of the handle 52. In the drawing, the handle is shown at one of such limits, and the recess or aperture 56 beneath the knob 55 thereof is not, of course, visible: to move the handle between its limits the knob 55 must first be pulled away from the backplate 50 to disengage from the recess or aperture 56 therebeneath.

[0020] At the upper part of the backplate 50, portions 58, 59 thereof are bent upwardly out of the plane of the backplate to afford brackets with which cable abutments

60, 61 are respectively adjustably engaged to hold the outer sheath elements 45, 43 of the Bowden cables extending to the respective transmission assemblies 32. The inner cable elements of these Bowden cables extend at 62, 42 to the cable drum 54, where nipples on the end of the inner cable elements are engaged in receiving formations 64, 65 in the cable drum. Thus angular movement of the handle 52, from a starting position (not illustrated) in which the knob 55 overlies the aperture 56 in the backplate 50, to the illustrated position, pulls on both the inner cable elements at the same time and effects substantially simultaneous disconnection of the clutch device in both the transmissions 32.

[0021] Thus the person behind the wheelchair is able with a single operation to disconnect both the wheelchair's motors from their associated wheels, and is then able to move the wheelchair on its wheels.

[0022] In the present specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

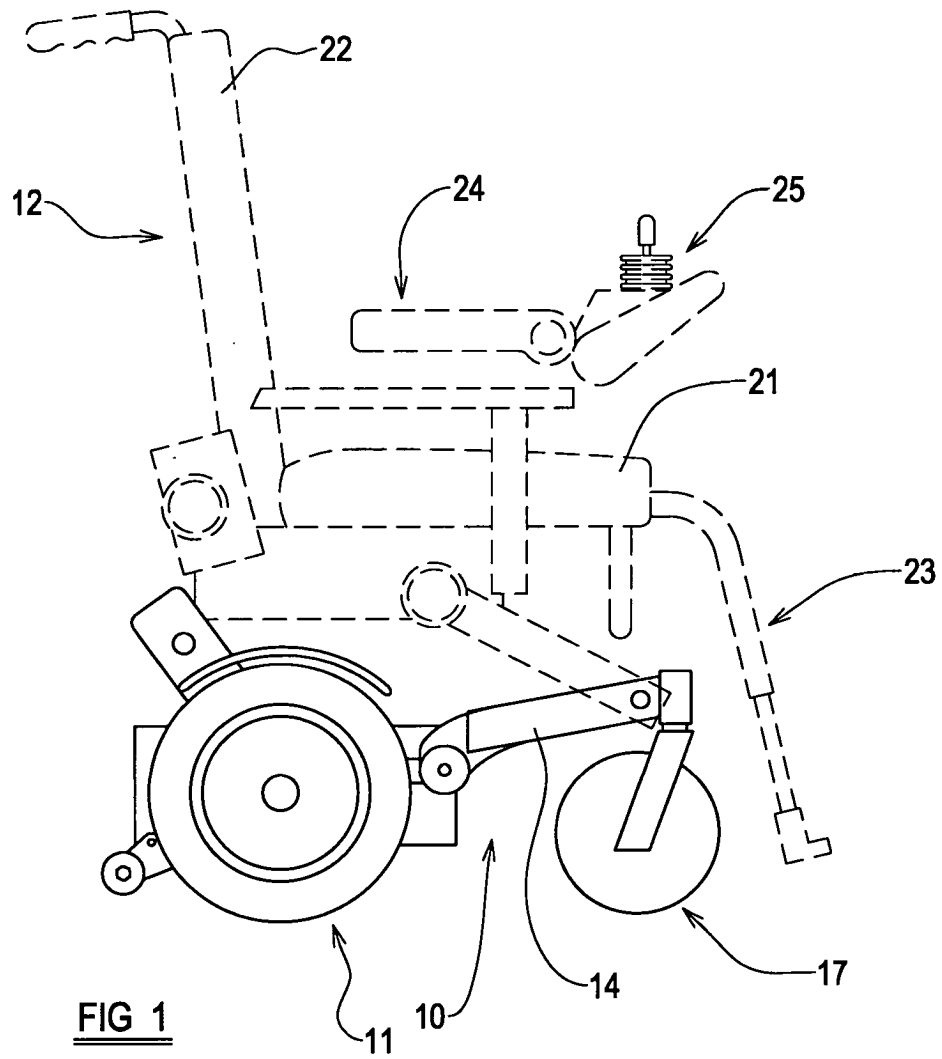
[0023] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

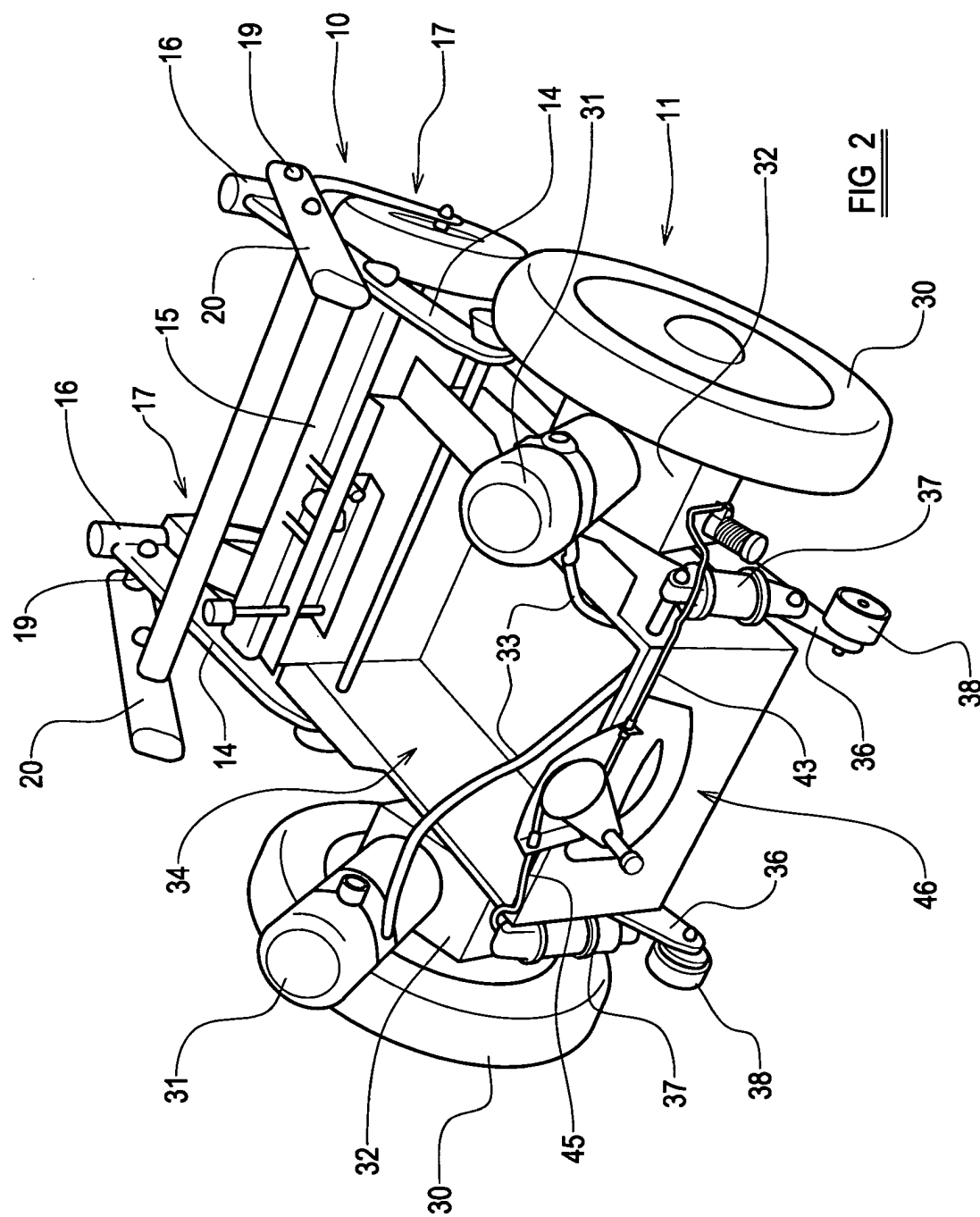
Claims

1. A powered vehicle for personal mobility, having respective motors (31) for driving respective wheels (30) of the vehicle and respective transmission arrangements (32) providing a driving connection between each motor and its associated wheel, which connection can be disengaged when required, **characterised by** a control means (46) operable on the transmission arrangements to disengage them all by one action.
2. A vehicle according to Claim 1 further **characterised in that** each of the transmission arrangements incorporates a clutch device by which disengagement of its driving connection can be effected.
3. A vehicle according to Claim 1 or Claim 2 further **characterised in that** the control means is operable on the transmission arrangements by way of respective Bowden cables (43, 45) extending therebetween.
4. A vehicle according to Claim 3 further **characterised in that** the control means comprises an angularly movable handle (52).
5. A vehicle according to any one of the preceding

claims which is a wheelchair.

6. A vehicle according to Claim 5 further **characterised in that** the control means is disposed at the rear of the wheelchair, so as to be operable by a person behind the wheelchair.
7. A vehicle according to Claims 5 or 6 further **characterised in that** the control means is accessible to a user occupying the wheelchair.





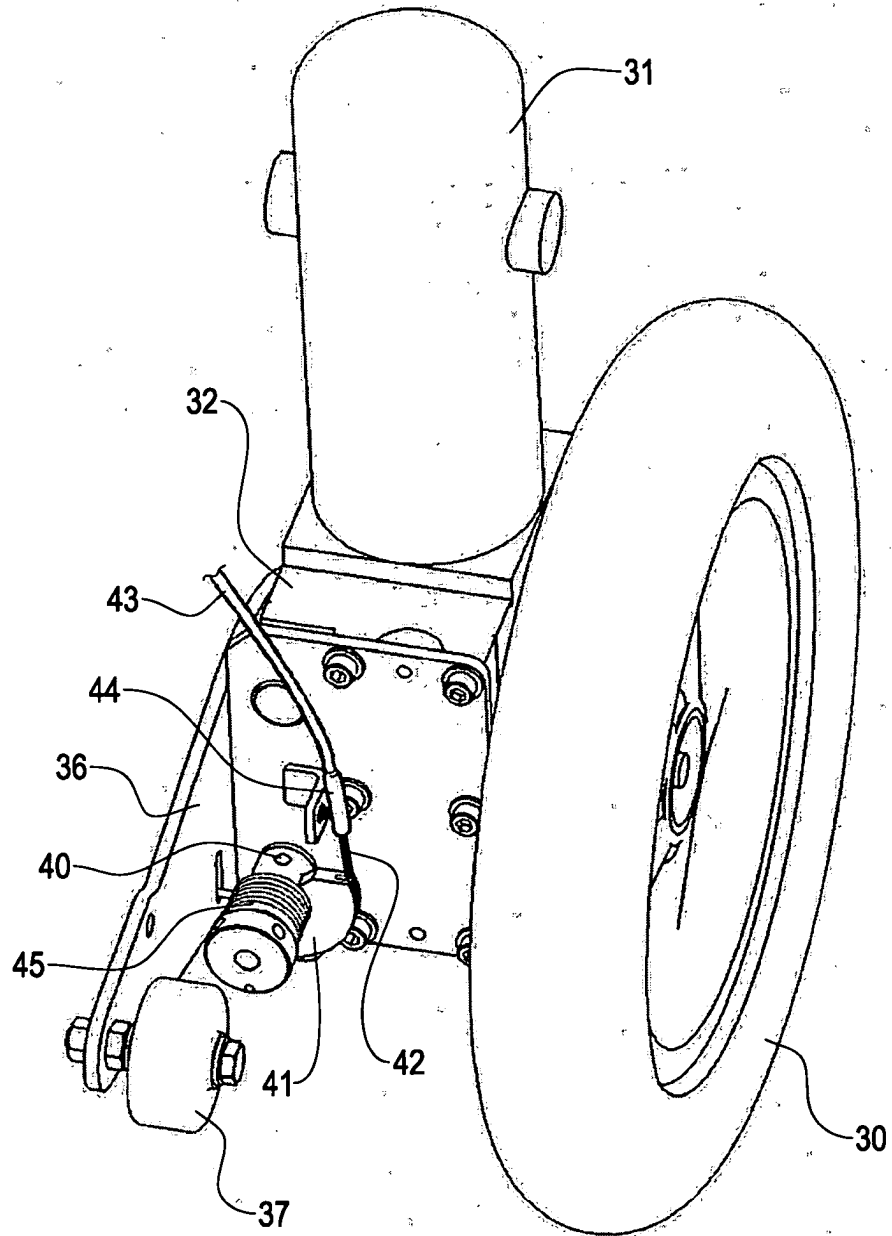


FIG 3

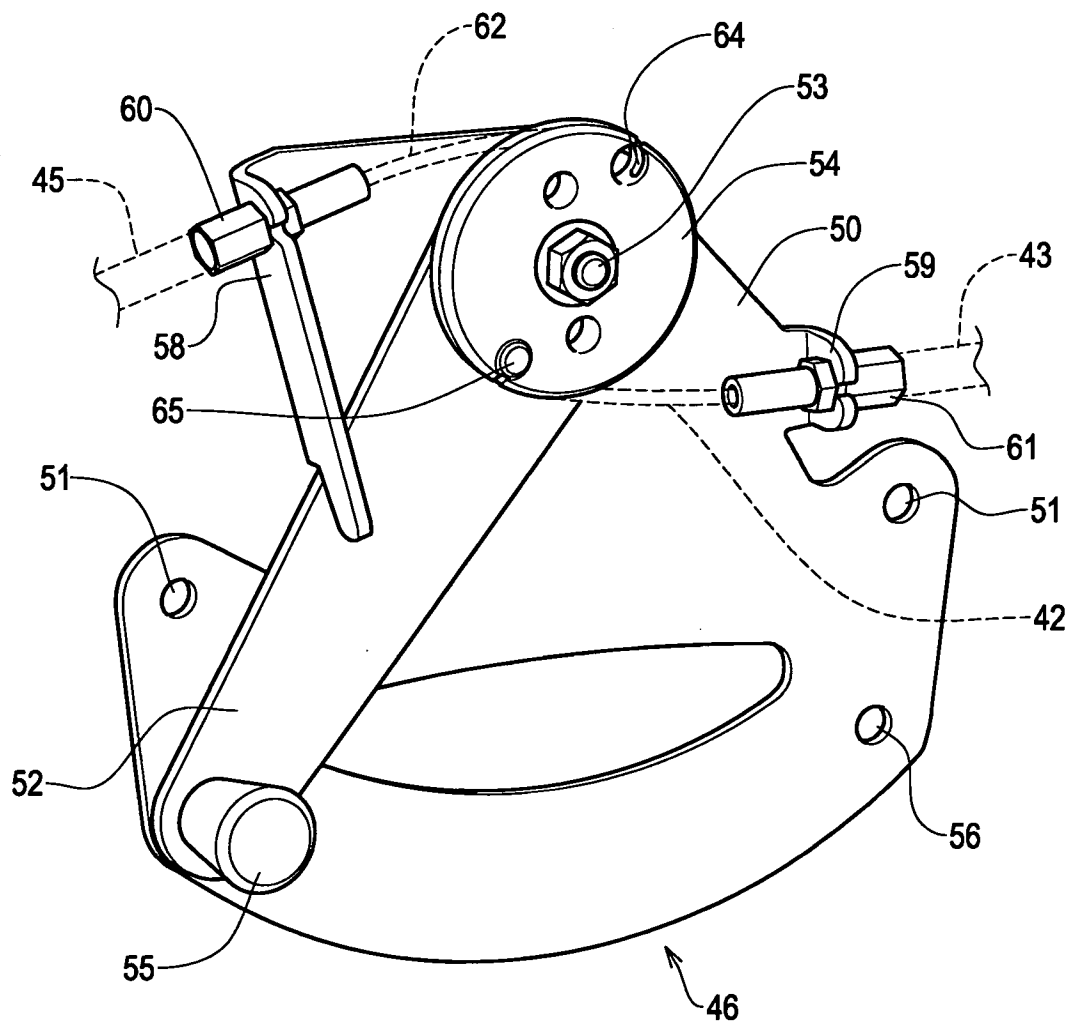


FIG 4



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EUROPEAN SEARCH REPORT

Application Number
EP 04 02 4408

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|---|----------------------------------|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
| X | DE 92 00 470 U (MEYRA WILHEM MEYER GMBH & CO KG) 27 February 1992 (1992-02-27) * page 2, line 31 - page 4; figures 1,2 * | 1-7 | A61G5/04 A61G5/08 |
| A | US 3 945 449 A (OSTROW HENRY J) 23 March 1976 (1976-03-23) * column 9, line 45 - column 10, line 30; figures 11-14 * | 1-7 | |
| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.7) |
| | | | A61G |
| The present search report has been drawn up for all claims | | | |
| Place of search | | Date of completion of the search | Examiner |
| The Hague | | 20 January 2005 | Birlanga Pérez, J-M |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | |

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 02 4408

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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20-01-2005

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