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(54) **Wheel chair**

(57) A wheel chair comprises a frame (1) and two front wheels (2, 3), which can each be driven by an electric motor (4, 5), and at least one centrally positioned castor (6, 7) present on the rear side, which is provided with a pivot pin (8) comprising a straight-ahead position. Furthermore a control unit (13) for the electric motors is provided, which control unit comprises a control element (14), by means of which the user can control the speed and the direction of the wheel chair. The control element

delivers a speed signal and a directional signal, whereby the control unit controls the electric motors in dependence on the output signals of the control element. A position sensor (17) delivers a rotational position signal in dependence on the rotational position of the pivot pin of the castor, whereby control means (18-21) are provided, which deliver a compensated directional signal to the control unit, such that the control unit controls the electric motors partially in dependence on the rotational position signal.

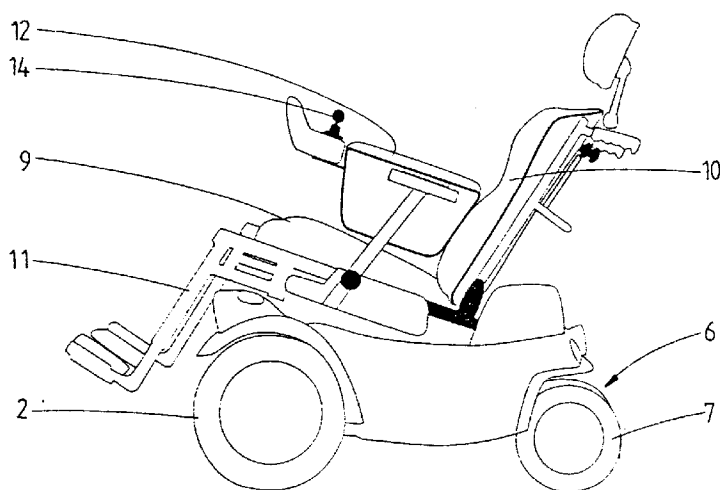


fig.1

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Description

The invention relates to a wheel chair comprising a frame and two front wheels, which can each be driven by an electric motor, and at least one castor present on the rear side, which is provided with a pivot pin comprising a straight-ahead position, and a control unit for the electric motors, which control unit comprises a control element, by means of which the user can control the speed and the direction of the wheel chair, which control element delivers a speed signal and a directional signal, whereby the control unit controls the electric motors in dependence on the output signals of said control element.

Such a wheel chair is described in the applicant's European patent application No. 9 520 638. The control unit operates in the usual manner, such that the speed signal determines the rotational speed of the electric motors, whilst a directional signal which indicates a deviation from the straight-ahead position effects a speed difference between the two electric motors. In order to ensure a proper directional stability in straight-ahead direction when moving at higher speeds, that is, speeds in excess of approximately 6 km/h, this wheel chair is fitted with a mechanical facility which exerts a rotary force on the pivot pin in the direction of the straight-ahead position when the pivot pin pivots from the straight-ahead position.

The object of the invention is to provide a wheel chair of the above-mentioned kind, wherein the control unit for the electric motors that is already present is used advantageously for ensuring a proper directional stability in straight-ahead direction.

In order to accomplish that objective the wheel chair according to the invention is fitted with a position sensor, which delivers a rotational position signal in dependence on the rotational position of the pivot pin of the castor, whereby control means are provided, which deliver a compensated directional signal to the control unit, such that the control unit controls the electric motors partially in dependence on the rotational position signal.

In this manner a wheel chair is obtained wherein the usual control unit is used advantageously by means of a simple electronic circuit for ensuring a proper directional stability in straight-ahead direction.

The invention will be explained in more detail hereafter with reference to the drawing, which shows an embodiment of the wheel chair according to the invention.

Fig. 1 is a side view of an embodiment of the wheel chair according to the invention.

Fig. 2 is a diagrammatic plan view of the frame of the wheel chair of Fig. 1.

Fig. 3 is a side view of the frame of Fig. 1.

Fig. 4 is a block diagram of the control means and the control unit of the wheel chair of Fig. 1.

Fig. 1 shows a side view of a wheel chair which comprises a frame 1 as shown in Figs. 1 and 2 and two front wheels 2 and 3, which can each be driven by an electric

motor 4 and 5 respectively. On the rear side frame 1 is supported by a centrally positioned castor assembly 6, which comprises two closely spaced wheels 7. Castor assembly 6 is provided with a pivot pin 8, which is illustrated in the straight-ahead position in the drawing. For a more detailed description of the construction of frame 1 and the associated parts reference is made to the applicant's above-mentioned European patent application No. 9 520 638.

As shown in Fig. 1, the wheel chair conventionally comprises a seat 9, an adjustable back support 10, leg supports 11 and armrests 12. The inclination of seat 9 is adjustable, as is described in more detail in the above-mentioned European patent application.

Electric motors 4 and 5 can be controlled by means of a control unit indicated at 13 in the diagram of Fig. 4, which control unit is known per se and need not be described in more detail herein, therefore. The control of electric motors 4, 5, and thus of the speed and the direction of the wheel chair, takes place by means of a control element 14, in the form of a joystick in the present embodiment, which is supported by one of the armrests 12, so that control element 14 is easy to operate for the user. Joystick 14 can be pivoted in all directions from a neutral position, in a manner which is known, whereby the direction in which the joystick is moved indicates the desired direction of movement of the wheel chair, and whereby the amount of travel of the joystick indicates the desired speed of the wheel chair. Joystick 14 delivers two output signals thereby, a speed signal 15 and a directional signal 16. Control unit 13 excites the electric motors 4 and 5 in dependence on these two signals. If directional signal 16 indicates a direction deviating from the straight-ahead direction, a speed difference between the two electric motors 4, 5 will be effected, such that the wheel chair will move in the desired direction.

It has become apparent that the stability of the castor assembly 6 is unsatisfactory at higher speeds, that is, speeds in excess of approximately 6 km/h, if no measures are taken to ensure directional stability of the castor assembly 6 in straight-ahead direction. The wheel chair described in the aforesaid European patent application No. 9 520 638 is fitted with a mechanical facility for that purpose, by means of which an excellent directional stability in straight-ahead direction is obtained.

In the wheel chair shown in the drawing a position sensor 17 is provided for ensuring a proper directional stability in straight-ahead direction, which sensor delivers a rotational position signal in dependence on the rotational position of pivot pin 8 of castor assembly 6. In the described embodiment position sensor 17 is a potentiometer, which can be turned through 360°. It is also possible to use other types of position sensors, however. The rotational position signal of position sensor 17 is preferably supplied to a processing element 20 via a limiting element 18, whose operation will be discussed in more detail hereafter, and a switch 19. Said process-

ing element 20 also receives the directional signal from control element 14. Processing element 20 combines the two input signals into a compensated directional signal, which is supplied to control unit 13. This means that when the rotational position signal of position sensor 17 indicates that pivot pin 8 has pivoted from the straight-ahead position, whilst the directional signal of operating element 14 indicates that the user wishes to move straight ahead, processing element 20 will deliver a directional signal to control unit 13 which causes control unit 13 to excite electric motors 4 and 5 unevenly, such that pivot pin 8 will return to the straight-ahead position. In a simple embodiment processing element 20 is to that end configured as an adding circuit, which adds the negative rotational position signal to the directional signal. Said adding circuit may for example comprise a differential amplifier.

Limiting element 18 limits the rotational position signal of position sensor 17 to a small deviation from the value associated with the straight-ahead position, so that the compensated directional signal that is supplied to control unit 13 is limited, so that on the one hand an overly strong reaction of electric motors 4, 5 is avoided, while on the other hand a desired change of direction effected by means of control element 14 remains possible.

Since the compensated directional signal for ensuring directional stability in straight-ahead direction is only required when moving ahead at a higher speed, the speed signal 15 of control element 14 is also supplied to a comparator 21, which compares the speed signal with a reference value V_{ref} , which corresponds with a predetermined minimum speed in forward direction. When said reference value is exceeded, comparator 21 will trip switch 19, so that the rotational position signal of position sensor 17 is only supplied to processing element 20 at a higher speed in forward direction.

Preferably an amplifier 22 is provided between position sensor 17 and limiting element 18, as a result of which even a small deviation from the straight-ahead position will lead to adequate compensation.

From the foregoing it will be apparent that the control unit 13 for ensuring directional stability in straight-ahead direction of the wheel chair, which control unit is already available, is used in an advantageous manner in the above-described wheel chair. In addition to that the safety of the wheel chair is improved by the fact that abrupt changes of course at higher speeds are prevented.

Although the above-described wheel chair uses a centrally positioned castor assembly, it is also possible, of course, to fit the wheel chair with two castor assemblies or with single castors at the outer ends of the wheel chair. In that case a position sensor may be placed on one of the pivot pins, or on both.

The invention is not limited to the above-described embodiment, which may be varied in various ways within the scope of the invention.

Claims

1. A wheel chair comprising a frame (1) and two front wheels (2, 3), which can each be driven by an electric motor (4, 5), and at least one centrally positioned castor (6, 7) present on the rear side, which is provided with a pivot pin (8) comprising a straight-ahead position, and a control unit (13) for the electric motors, which control unit comprises a control element (14), by means of which the user can control the speed and the direction of the wheel chair, which control element delivers a speed signal (15) and a directional signal (16), whereby the control unit controls the electric motors in dependence on the output signals of said control element, **characterized by** a position sensor (17), which delivers a rotational position signal in dependence on the rotational position of the pivot pin (8) of the castor (6, 7), wherein control means (18-21) are provided, which deliver a compensated directional signal to the control unit (13), such that the control unit controls the electric motors (4, 5) partially in dependence on the rotational position signal.
2. A wheel chair according to claim 1, **characterized in that** said control means (18-21) comprise a processing element (20), which combines the directional signal from the control element (14) with the rotational position signal from the position sensor (17) into a compensated directional signal for the control unit (13).
3. A wheel chair according to claim 2, **characterized in that** said position sensor (17) is connected to the processing element (20) via a switch (19), wherein means (21) are provided which trip the switch if the speed signal from the control element exceeds a threshold value, which threshold value preferably corresponds with a minimum speed in forward direction.
4. A wheel chair according to claim 3, **characterized in that** said speed signal (15) is supplied to a comparator (21), whose output controls said switch (19).
5. A wheel chair according to claim 2, 3 or 4, **characterized in that** said processing element (20) is an adding circuit, which adds the negative rotational position signal to the directional signal (16).
6. A wheel chair according to any one of the preceding claims, **characterized in that** a limiting element (18) is provided, which limits the rotational position signal to a predetermined rotation from the straight-ahead position of the pivot pin (8).
7. A wheel chair according to claim 6, **characterized in that** an amplifier (22) is provided between said

position sensor (17) and said limiting element (18).

8. A wheel chair according to any one of the preceding claims, **characterized in that** said position sensor (17) is a potentiometer, which can be turned through 360°.

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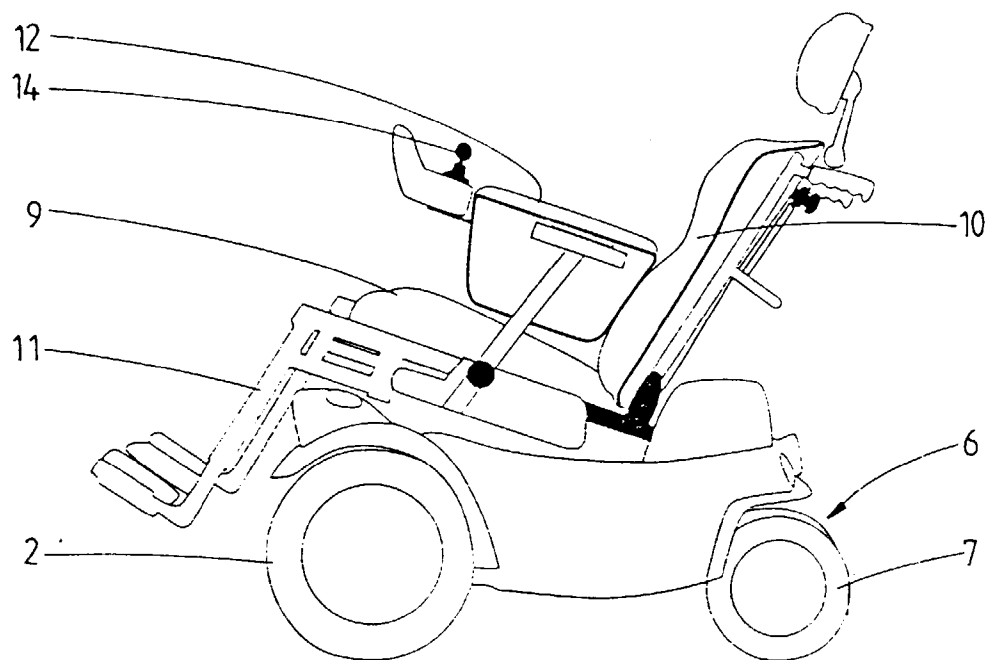


fig.1

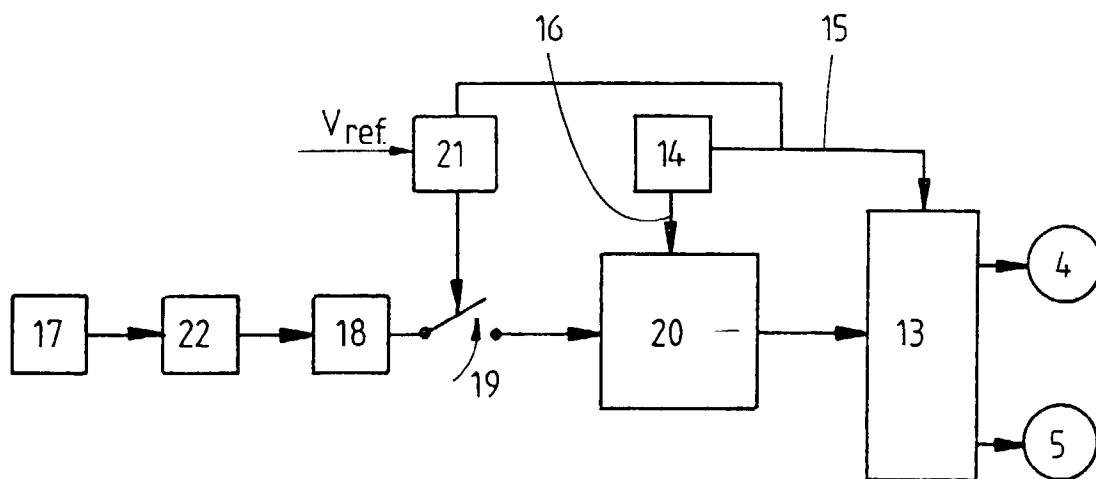


fig.4

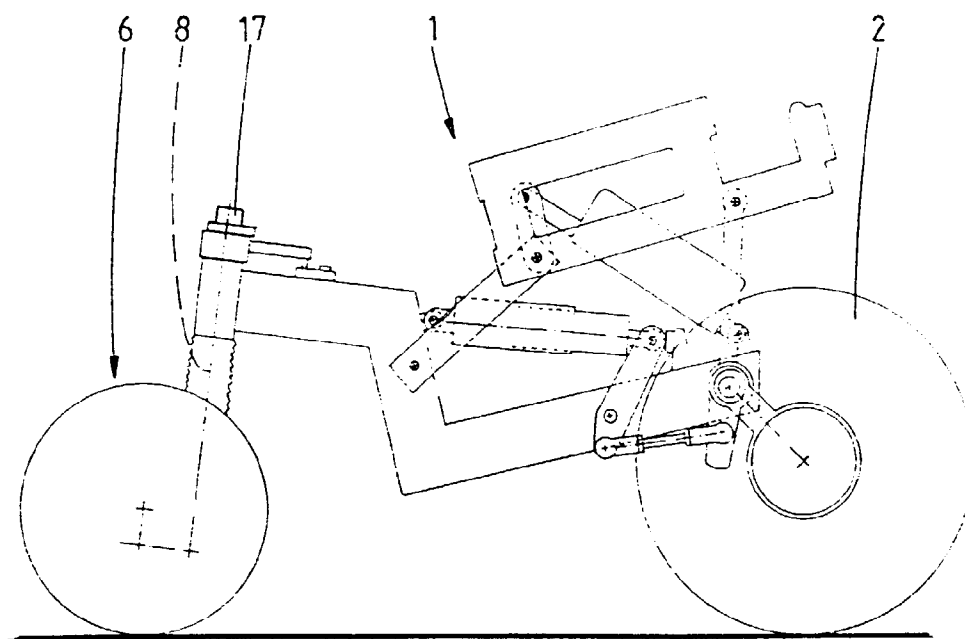


fig. 2

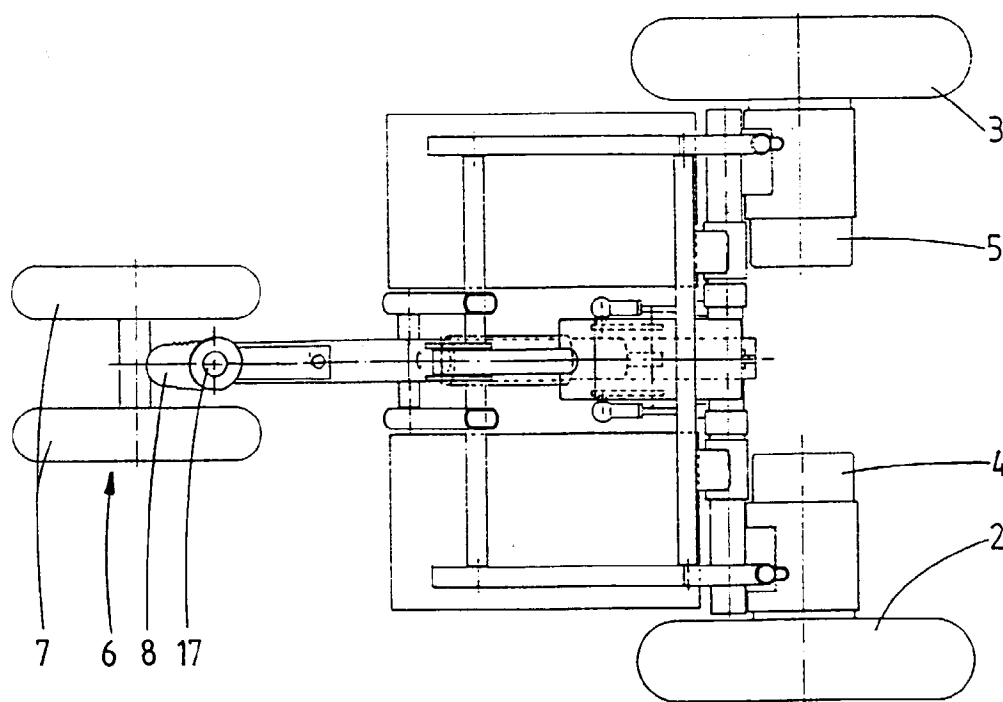


fig. 3