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Wheel assembly for a wheelchair

Abstract

Wheel assembly, in particular for a wheel chair comprising. The wheel assembly includes a wheel shaft extending along a shaft axis and which is configured to be non-rotatably connectable to a frame of the wheelchair. A wheel with a wheel hub is mounted on the wheel shaft so as to be rotatable around the shaft axis. The wheel assembly is provided with a hub motor having a power input and with a rim handle connected to the wheel and being rotatable relative to the wheel over an angle. A resolver assembly of the wheel assembly comprises a wheel resolver which is configured to generate a wheel resolver signal, a rim handle resolver which is configured to generate a rim handle resolver signal, and at least one resolver assembly output for outputting the wheel resolver signal and the rim handle resolver signal.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This application claims priority under 35 U.S.C. § 119 to Application NL 2030598, filed Jan. 18, 2022, which is hereby incorporated by reference in its entirety.

FIELD

(2) The invention relates to a wheel assembly for a wheelchair and to a wheelchair provided with such a wheel assembly.

BACKGROUND

(3) A wheel assembly for a wheelchair is known from EP2708217A1. The known wheel assembly comprises a wheel shaft which is configured to be non-rotatably connectable to a frame of the wheelchair. A wheel including a wheel hub is mounted on the wheel shaft so as to be rotatable around the shaft axis. The known wheel assembly additionally comprises a hub motor having a power input. A rim handle is connected to the wheel and rotatable relative to the wheel over an angle.

(4) The known wheel assembly has a rotational displacement detection mechanism configured to detect a rotational displacement of the rim relative to the wheel hub. The known rotational displacement detection mechanism comprises an annular permanent magnet and a so-called Hall element. This specific configuration is relatively expensive.

SUMMARY

(5) The object of the present invention is to provide a wheel assembly having an alternative solution for detecting rotational displacement of the rim handle relative to the wheel which is reliable and which can be manufactured economically.

(6) To that end, the invention provides a wheel assembly according to claim **1**. More in particular, the invention provides a wheel assembly for a wheelchair, the wheel assembly comprising:

(7) a wheel shaft extending along a shaft axis and which is configured to be non-rotatably connectable to a frame of the wheelchair; a wheel with a wheel hub which is mounted on the wheel shaft so as to be rotatable around the shaft axis; a hub motor having a power input; a rim handle connected to the wheel and being rotatable relative to the wheel over an angle; a resolver assembly comprising: a wheel resolver which is configured to generate a wheel resolver signal; a rim handle resolver which is configured to generate a rim handle resolver signal; at least one resolver assembly output for outputting the wheel resolver signal and the rim handle resolver signal.

(8) Due to the fact that a resolver assembly is used, the permanent magnet and the Hall-element can be disposed of. No wiring has to be connected to rotating parts nor wipers or brush contacts have to be used. The resolver assembly can be manufactured at relatively low costs. The power source and the controller may be external from the wheel assembly and may, for example, be positioned under the seat of the wheelchair. Thus, exchangeability of the wheel assembly may be relatively easy. To that end, just the power input as well as the resolver assembly output may have to be disconnected and the wheel shaft may be disconnected from the frame of the wheelchair to disassemble the wheel assembly from the frame of the wheelchair.

(9) The invention also provides an assembly of the wheel assembly according to the invention, wherein the assembly further comprises a variable power supply of which an output is connected to the power input of the hub motor, and wherein the assembly comprises an electronic controller having an input assembly to which the at least one resolver assembly output is connected and having an output which is connected to the variable power supply for controlling the output power of the power supply. The electronic controller is configured for processing the wheel resolver signal and the rim handle resolver signal and to generate in dependence of at least those two signals a power supply control signal.
(10) The invention also provides a wheelchair comprising a wheel assembly according to the invention.
(11) The wheelchair according to the invention has the same advantages as have been described above with reference to the wheel assembly.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** shows an elevational view from an example of a wheel assembly;
(2) FIG. **2** shows perspective view of the wheel assembly of FIG. **1** from a first point of view;
(3) FIG. **3** shows a perspective view of the wheel assembly of FIG. **1** from a second point of view;
(4) FIG. **4** shows a cross-section over line IV-IV in FIG. **1**;
(5) FIG. **5** shows detail V of FIG. **4**;
(6) FIG. **6** shows detail VI of FIG. **5**;
(7) FIG. **7** shows an exploded perspective view of the wheel assembly of FIG. **2** from the first point of view;
(8) FIG. **8** shows an exploded perspective view of the wheel assembly of FIG. **3** from the second point of view;
(9) FIG. **9** shows detail IX from FIG. **8**;
(10) FIG. **10** shows detail X from FIG. **7**;
(11) FIG. **11** shows a front side of the base print board;
(12) FIG. **12** shows a front side of the rim handle print board;
(13) FIG. **13** shows a front side of the wheel print hoard;
(14) FIG. **14** shows a rear side of the base print board;
(15) FIG. **15** shows a rear side of the rim handle print board;
(16) FIG. **16** shows a rear side of the wheel print board; and
(17) FIG. **17** shows a wheelchair with two wheel assemblies.
DETAILED DESCRIPTION
(18) In this application similar or corresponding features are denoted by similar or corresponding reference signs. The description of the various embodiments is not limited to the examples shown in the figures and the reference numbers used in the detailed description and the claims are not intended to limit the description of the embodiments, but are included to elucidate the embodiments.
(19) In most general terms, the invention provides a wheel assembly **10** for a wheelchair. The wheel assembly **10** comprises a wheel shaft **20** extending along a shaft axis and which is configured to be non-rotatably connectable to a frame of the wheelchair. A wheel **12** including a wheel hub **48** is mounted on the wheel shaft **20** so as to be rotatable around the shaft axis. The wheel assembly **10** comprises a hub motor **14** having a power input. The wheel assembly **10** further has a rim handle **18** which is connected to the wheel **12** and which is rotatable relative to the wheel over an angle α. A resolver assembly **21** is provided which comprises a wheel resolver **22** which is configured to generate a wheel resolver signal S**1**, as well as a rim handle resolver **24** which is

configured to generate a rim handle resolver signal S**2**. The resolver assembly **21** has a resolver assembly output **21***a* for outputting the wheel resolver signal S**1** and the rim handle resolver signal S**2**.
(20) The advantages which are described in the summary above are incorporated here by reference to what has been explained in the summary.
(21) In an embodiment, of which an example is shown in the figures, the resolver assembly may comprise a base print board **26** which is non-rotatably connected to the wheel shaft **20**, a wheel print board **28** which is non-rotatably connected to the wheel **12**, and a rim handle print board **30** which is non-rotatably connected to the rim handle **18**.
(22) By virtue of the fact that the resolver assembly **21** is, in fact, formed by three printed circuit boards **26**, **28**, **30**, the costs for manufacturing the resolver assembly **21** may be relatively low. Additionally, the accuracy of the signals S**1** and S**2** which may be generated by the wheel resolver **22** and the rim handle resolver **24** may be very accurate and the response time may be extremely short, in fact almost real time. Thus, any displacement of the rim handle **18** relative to the wheel **12** can be accurately and quickly monitored. As a consequence, the power assist function which may be provided by the wheel assembly may be very accurate and quick.
(23) In an embodiment, the base print board **26** may be positioned between the wheel print board **28** and the rim handle print board **30**. Thus the strength of the wheel resolver signal S**1** and the rim handle resolver signal S**2** may be of substantially equal strength.
(24) In an embodiment, of which an example is shown in the figures, the base print board **26** may comprise a first base print board coil track **36** which is connectable to an electronic controller **44** and which is configured for generating a first magnetic field, wherein the windings of the first base print board coil track **36** are substantially concentric with the shaft axis.
(25) In an embodiment, of which an example is shown in the figures, the base print board **26** may comprise a second base print board coil track **38** which is connectable to an electronic controller **44** and which is configured for generating a second magnetic field, wherein the windings of the second base print board coil track **38** are substantially concentric with the shaft axis.
(26) In an embodiment, of which an example is shown in the figures, the wheel print board **28** may comprises a wheel print board conductive track **32** which is electrically closed and extends with a meandering pattern, e.g. a zig-zag pattern or a crenellated pattern, over a pitch circle P**1** which is concentric with the shaft axis and which has a first radius, wherein the base print board **26** has at least one first base print board detection track **40**, which extends with a similar meandering pattern as the wheel print board conductive track **32**, e.g. a zig-zag pattern or a crenellated pattern, over a pitch circle P**1**′ which is concentric with the shaft axis and which also has the first radius, wherein the at least one first base print board detection track **40** is connectable to an input assembly of an electronic controller **44**.
(27) In an embodiment, of which an example is shown in the figures, the rim handle print board **30** comprises a rim handle print board conductive track **34** which is electrically closed and extends with a meandering pattern, e.g. a zig-zag pattern or a crenellated pattern, over a pitch circle P**2** which is concentric with the shaft axis and which has a second radius, wherein the base print board **26** has at least one second base print board detection track **42** which extends with a similar meandering pattern as the rim handle plate conductive track **34**, e.g. a zig-zag pattern or a crenellated pattern, over a pitch circle P**2**′ which is concentric with the shaft axis and which also has a second radius, wherein the at least one second base print board detection track **42** is connectable to an input assembly of an electronic controller **44**.
(28) The base print board **26**, the wheel print board **28** and the rim handle print board **30** as described above may be manufactured with conventional print board manufacturing techniques and thus the costs of these respective print boards **26**, **28**, **30** may be relatively low.
(29) The meandering patterns may include a plurality of similarly shaped consecutive periodic structures, e.g. one zig-zag structure or one crenellation including a top and a valley. In an

embodiment, each periodic structure may extend over a pitch angle of the pitch circle which is in the range of 3°-36°. With a periodic structure which extends over the pitch angle as claimed, sufficiently accurate signals may be generated by the wheel resolver **22** and the rim handle resolver **24** to obtain real time information about the motion of the rim handle **18** relative to the wheel **12**. In a practical example, the at least one first base print board detection track **40** may comprise two first base print board detection tracks **40** which may be off-set over an angle relative to each other. The same may be the case for the at least one second base print board detection track **42** which may, in a practical example, be formed by two second base print board detection tracks **42** which are angularly offset relative to each other. This may provide a more robust and reliable wheel resolver signal S**1** and rim handle resolver signal S**2**.

(30) In an embodiment, of which an example is shown in the figures, the hub motor **14** may comprise a stator **46** which is non-rotatably connected with the wheel shaft **20**. The hub motor **14** also may comprise the wheel hub **48**. The wheel hub **48** may comprise a wheel hub housing **53**, a first wheel hub cover plate **54** and a second wheel hub cover plate **55** which are connected to the wheel hub housing **53** and which together bound a wheel hub chamber in which the stator **46** is accommodated. A wheel print board carrier **58** is connected to the wheel hub **48** and the wheel print board **28** is mounted on the wheel print board carrier **58**.

(31) Thus, the wheel print hoard **28** rotates along with the wheel hub **48** and the wheel **12**.

(32) In the example shown in the drawings, the wheel hub **48** also constitutes the rotor of the hub motor **14**. In other words, the hub motor **14** shown in the example is of the direct drive type. The invention is not limited to wheel assemblies **10** with directly driven hub motors **14**. It is also possible that a transmission, for example a planetary gear transmission is mounted between the wheel hub **48** and the rotor of the hub motor **14**.

(33) In an embodiment, of which an example is shown in the FIGS. **8** and **9**, the wheel assembly **10** may comprise a rim handle connection assembly **70** via which the rim handle **18** is connected to the wheel hub **48** of the wheel **12**.

(34) The rim handle connection assembly **70** allows rotational motion of the rim handle **18** relative to the wheel hub **48**. Preferably, the rim handle connection assembly **70** comprises rim handle connection springs **72** which bias the rim handle **18** in a neutral position relative to the wheel hub **48** and thus relative to the wheel **12**. In order to prevent unwanted oscillation of the rim handle **18** relative to the wheel hub **48** and the wheel **12**, rim handle connection dampers **74** may be provided as well.

(35) In an embodiment, of which an example is shown in the FIGS. **3**, **7** and **8**, the wheel assembly **10** may comprise rim handle spokes **66** which are connected at a radial outer end with the rim handle **18**. Inner radial ends of the rim handle spokes **66**A may be connected to a connection assembly cover plate **82** as is visible in FIGS. **3** and **8**.

(36) As explained above, in an embodiment, the rim handle connection assembly **70** may comprise rim handle connection springs **72** via which the connection assembly cover plate **82** is connected with the wheel hub **48** as well as rim handle connection dampers **74** via which the connection assembly cover plate **82** is connected with the wheel hub **48**. The rim handle connection spring **72** allow the rotation of the rim handle **18** relative to the wheel hub **48** and wheel **12** and additionally urge or bias the rim handle **18** in a neutral position relative to the wheel hub **48** and the wheel **12**. The rim handle connection dampers **74** also allow the rotation of the rim handle **18** relative to the wheel hub **48** and wheel **12** and have the function of damping unwanted rotational oscillation between the rim handle **18** on the one hand and the wheel hub **48** and the wheel **12** on the other hand.

(37) In an embodiment, of which an example is visible in FIGS. **9** and **10**, the rim handle connection spring **72** and/or the rim handle connection dampers **74** may be exchangeable for tailoring the handling characteristics of the wheel assembly **10** to needs of a type of user. Thus, by exchanging the springs **72** and/or the dampers **74**, for example, the force which is needed to

angularly move the rim handle **18** relative to the wheel hub **48** may be varied and tailored to the force of a type of user.

(38) The embodiment of the connection assembly **70** described above provides a stable connection between the rim handle **18** and the wheel hub **48** which substantially only allows rotation of the rim handle **18** relative to the wheel hub **48** over a limited angle and which additionally prevents unwanted rotational oscillation of the rim handle **18** relative to the wheel hub **48**. Further, a high stability of the rim handle **18** relative to the wheel **12** is obtained with this connection assembly which substantially prevents movement of the rim handle **18** relative to the wheel **12** apart from the above described relative rotation over a limited rotation angle.

(39) In an embodiment, the rim handle spokes **66** or the connection assembly cover plate **82** may be provided with rim handle connection struts **68** which extend from a rim handle side of the wheel **12** to an opposite, resolver assembly side of the wheel **12**. An example of rim handle connection struts **68** is visible in FIGS. **7** and **10**. A rim handle print board carrier **56** positioned at the resolver assembly side of the wheel **12** is connected to the rim handle connection struts **68**. In FIG. **7** strut parts **68′** are indicated which are connectable to the struts **68** which may be, as shown in the example of FIG. **7**, connected to the rim handle spokes **66** or the connection assembly cover plate **82**. In this embodiment, the rim handle print board **30** is mounted on the rim handle print board carrier **56**.

(40) In an embodiment, of which an example is shown in the figures, the wheel assembly **10** may comprise a base print board carrier **60** (see FIGS. **5**-**8**) which is rotatably fixed relative to the wheel shaft **20** and on which the base print board **26** is mounted.

(41) In an embodiment, of which an example is shown in the figures, the wheel assembly **10** may comprise a resolver assembly cover plate **62** (see FIGS. **7** and **8**) which is releasably connected to the wheel shaft **20** and to which the base print board carrier **60** may be releasably connected.

(42) The wheel assembly **10** may comprise a brake disk **64** which is releasably connected to the wheel hub **48**, in particular to the hub cover plate **54**. Please refer to FIGS. **6**, **7** and **8**. The brake disk **64** may mounted at a side of the resolver assembly cover plate **62** which is opposite the resolver assembly **21**. A brake disk cover plate **92** is mounted on the resolver assembly cover plate **62** so as to form a brake disk chamber **94**.

(43) The wheel assembly **10** may comprise a wheel rim **50**, a tire **80** mounted on the wheel rim **50**, and a plurality of spokes **52** which connect the wheel rim **50** with the wheel hub **48**.

(44) In an embodiment, of which an example is in FIG. **7**, the stator **46** of the wheel assembly may comprise a plurality of hub motor coils **76**. The wheel hub **48** may comprise a plurality of permanent hub motor magnets **78**.

(45) In an embodiment, of which an example is shown in the FIG. **4**, the wheel assembly **10** may further comprise a variable power supply **16** of which an output **16***b* is connected to the power input of the hub motor **14**. The wheel assembly **10** may additionally comprise an electronic controller **44** having an input assembly **44***a* to which the at least one resolver assembly output **21***a* is connected and having an output **44***b* which is connected to an input assembly **16***b* of the variable power supply **16** for controlling the output power of the power supply **16**. The electronic controller **44** is configured for processing the wheel resolver signal S**1** and the rim handle resolver signal S**2** and to generate in dependence of at least those two signals S**1**, S**2** a power supply control signal S**3**.

(46) The variable power supply **16** and the electronic controller **44** may be mounted in the wheelchair, and be connected to the frame of the wheelchair. However, it is not excluded that the power supply and the electronic controller are directly connected to e.g. the wheel shaft **20** so that with removal of the wheel assembly **10**, also the power supply **16** and the electronic controller **44** are removed from the wheelchair.

(47) In a further elaboration of the previous embodiment, the power supply control signal S**3** has a positive substantially linear relation with the power supplied by the variable power supply **16** to the hub motor **14**.

(48) In other words, the higher the control signal S**3**, the higher the power supplied by the variable power supply **10** to the hub motor **14**.
(49) In a further elaboration of the previous embodiment, wherein the power supply control signal S**3** is dependent on the average difference between wheel resolver signal S**1** and the handle resolver signal S**2** during a number of sampling periods.
(50) A sampling period may e.g. be in the range of 0.001 to 0.2 s. The number n of sampling periods may e.g. be 10. For example, when the sampling period is 0.01 s and the number of sampling periods is 10, then the ten signal difference values S**2**−S**1** measured at subsequent periods i (i being 1 to 10), i.e. 10 signal differences which are measured in a total time span of 0.1 s are added and divided by n, i.e. in this example by 10. For n measurements of signal differences S**2**−S**1**, the average signal difference is defined by the following formula:
(51) $\text{averagesignaldifference} = \frac{\text{.Math.}_{i=1}^{n} (S2 - S1)_i}{n}$
(52) By using an average signal difference, the variation in power supply to the hub motor **14** may be smoothened and not be immediately dependent on each signal difference S**2**−S**1** which is measured. This may improve the perception of the user who is exerting a force on the rim handle **18**. It should be noted that the electronic controller **44** may include many more algorithms to further improve the power assist perception of the user. For example, algorithms may be used to evaluate both the signals S**1** and S**2** of the right wheel assembly **10** as well as the signal S**1**′ and S**2**′ of the left wheel assembly **10**′ of a wheelchair and in dependence of this evaluation generate signals S**3**, S**3**′ which take into account the results of the evaluation.
(53) In a further embodiment, the electronic controller **44** may supply an alternating current to the first base print coil track **36** to generate the first magnetic field. This first magnetic field, in turn, generates an alternating current in the wheel print board conductive track **32**, which in turn, generates a series of third magnetic fields around the meandering pattern of the wheel print board conductive track **32**. This series of third magnetic fields, in turn, generates an alternating current in the at least one first base print board detection track **40** which is the wheel resolver signal S**1**.
(54) The electronic controller **44** may additionally supply an alternating current to the second base print coil track **38** to generate the second magnetic field. This second magnetic field, in turn generates an alternating current in the rim handle print board conductive track **34**, which, in turn, generates a series of forth magnetic fields around the meandering pattern of the rim handle print board conductive track **32**. This series of fourth magnetic fields, in turn, generates an alternating current in the at least one second base print board detection track **42** which is the rim handle resolver signal S**2**.
(55) In the above described embodiment, the base print board has two coil tracks **36** and **38**, wherein the first base print coil track **36** provides the power for generating the first resolver signal S**1** and wherein the second base print coil track **38** provides the power for generating the second resolver signal S**2**.
(56) In an alternative embodiment, it is also feasible that the base print board **30** only has a single base print coil track **36**. In such an embodiment, the electronic controller **44** may supply an alternating current to the first base print coil track **36** to generate the first magnetic field, which in turn generates an alternating current in the wheel print board conductive track **32**, which in turn generates a series of third magnetic fields around the meandering pattern of the wheel print board conductive track **32**. This series of third magnetic fields, in turn, generates an alternating current in the at least one first base print board detection track **40** which is the wheel resolver signal S**1**. The first magnetic field additionally generates an alternating current in the rim handle print board conductive track **34**, which in turn generates a series of fourth magnetic fields around the meandering pattern of the rim handle print board conductive track **32**. This series of fourth magnetic fields, in turn, generates an alternating current in the at least one second base print board detection track **42** which is the rim handle resolver signal S**2**.
(57) FIG. **17** shows an example of a wheel chair being provide with two wheel assemblies **10**.

(58) Although illustrative embodiments of the present invention have been described above, in part with reference to the accompanying drawings, it is to be understood that the invention is not limited to these embodiments. Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims.
(59) Reference throughout this specification to “one embodiment” or “an embodiment” means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this description are not necessarily all referring to the same embodiment.
(60) Furthermore, it is noted that particular features, structures, or characteristics of one or more of the various embodiments which are described above may be used implemented independently from one another and may be combined in any suitable manner to form new, not explicitly described embodiments. The reference numbers used in the detailed description and the claims do not hunt the description of the embodiments, nor do they limit the claims. The reference numbers are solely used to clarify.
LIST OF ELEMENTS
(61) **10**. wheel assembly **12**. wheel **14**. hub motor **16**. variable power supply **18**. rim handle **20**. wheel shaft **21**. resolver assembly **22**. wheel resolver **24**. rim handle resolver **26**. base print board **28**. wheel print board **30**. rim handle print board **32**. wheel print hoard conductive track **34**. rim handle print board conductive track **36**. first base print board coil track **38**. second base print board coil track **40**. first base print board detection track **42**. second base print board detection track **44**. electronic controller **46**. stator **48**. wheel hub **50**. wheel rim **52**. spokes **53**. wheel hub housing **54**. first wheel hub cover plate **55**. second wheel hub cover plate **56**. rim handle print board carrier **58**. wheel print hoard carrier **60**. base print board carrier **62**. resolver assembly cover plate **64**. brake disk **66**. rim handle spokes **68**. rim handle connection struts **68**′. rim handle connection struts **70**. rim handle connection assembly **72**. rim handle connection springs **74**. rim handle connection dampers **76**. hub motor coils **78**. hub motor magnets **80**. tire **82**. connection assembly cover plate **92**. brake disk cover plate **94**. brake disk chamber **96**. cable assembly **98**. bearings P**1**. pitch circle on wheel print board **28** P**2**. pitch circle on rim handle print board **30** P**1**′. pitch circle on base print board **26** P**2**′. pitch circle on base print board **26** S**1**. Wheel resolver signal S**2**. Rim handle resolver signal S**3**. Power supply control signal **100**. Wheel chair

Claims

1. A wheel assembly for a wheelchair, the wheel assembly comprising: a wheel shaft extending along a shaft axis and which is configured to be non-rotatably connectable to a frame of the wheelchair; a wheel including a wheel hub, the wheel being mounted on the wheel shaft so as to be rotatable around the shaft axis; a hub motor having a power input; a rim handle connected to the wheel and being rotatable relative to the wheel over an angle (α); a resolver assembly comprising: a wheel resolver which is configured to generate a wheel resolver signal; a rim handle resolver which is configured to generate a rim handle resolver signal; at least one resolver assembly output for outputting the wheel resolver signal and the rim handle resolver signal.
2. The wheel assembly according to claim 1, wherein the resolver assembly comprises: a base print board which is non-rotatably connected to the wheel shaft; a wheel print board which is non-rotatably connected to the wheel; and a rim handle print board, which is non-rotatably connected to the rim handle.
3. The wheel assembly according to claim 2, wherein the base print board is positioned between the wheel print board and the rim handle print board.
4. The wheel assembly according to claim 2, wherein the base print board comprises a first base

print board coil track which is connectable to an electronic controller and which is configured for generating a first magnetic field, wherein the windings of the first base print board coil track are substantially concentric with the shaft axis.
5. The wheel assembly according to claim 4, wherein the base print board comprises a second base print board coil track which is connectable to an electronic controller and which is configured for generating a second magnetic field, wherein the windings of the second base print board coil track are substantially concentric with the shaft axis.
6. The wheel assembly according to claim 2, wherein the wheel print board comprises a wheel print board conductive track which is electrically closed and extends with a meandering pattern over a pitch circle which is concentric with the shaft axis and which has a first radius, wherein the base print board has at least one first base print board detection track which extends with a similar meandering pattern as the wheel print board conductive track over a pitch circle which is concentric with the shaft axis and which also has the first radius, wherein the at least one first base print board detection track is connectable to an input assembly of an electronic controller.
7. The wheel assembly according to claim 6, wherein the meandering pattern includes a plurality of similarly shaped consecutive periodic structures, wherein each periodic structure extends over a pitch angle of the pitch circle which is in the range of 3°-36°.
8. The wheel assembly according to claim 2, wherein the rim handle print board comprises a rim handle print board conductive track which is electrically closed and extends with a meandering pattern over a pitch circle which is concentric with the shaft axis and which has a second radius, wherein the base print board has at least one second base print board detection track which extends with a similar meandering pattern as the rim handle plate conductive track over a pitch circle which is concentric with the shaft axis and which also has a second radius, wherein the at least one second base print board detection track is connectable to an input assembly of an electronic controller.
9. The wheel assembly according to claim 2, wherein the hub motor comprises: a stator which is non-rotatably connected with the wheel shaft and the wheel hub, the wheel hub comprising a wheel hub housing, a first wheel hub cover plate and a second wheel hub cover plate which are connected to the wheel hub housing and which together bound a wheel hub chamber in which the stator, is accommodated, wherein a wheel print board carrier is connected to the wheel hub, wherein the wheel print board is mounted on the wheel print board carrier.
10. The wheel assembly according to claim 9, wherein the stator comprises a plurality of hub motor coils, and wherein the wheel hub comprises a plurality of permanent hub motor magnets.
11. The wheel assembly according to claim 2, comprising: a base print board carrier which is rotatably fixed relative to the wheel shaft and on which the base print board is mounted.
12. The wheel assembly according to claim 11, comprising: a resolver assembly cover plate which is releasably connected to the wheel shaft and to which the base print board carrier is releasably connected.
13. The wheel assembly according to claim 1, comprising: a rim handle connection assembly, via which the rim handle is connected to the wheel hub of the wheel.
14. The wheel assembly according to claim 13, comprising: rim handle spokes which are connected at a radial outer end with the rim handle; a connection assembly cover plate to which are connected inner radial ends of the rim handle spokes; wherein the rim handle connection assembly comprises: rim handle connection springs via which the connection assembly cover plate is connected with the wheel hub; rim handle connection dampers via which the connection assembly cover plate is connected with the wheel hub.
15. The wheel assembly according to claim 14, wherein the rim handle connection spring and/or the rim handle connection dampers are exchangeable for tailoring the handling characteristics of the wheel assembly to needs of the user.
16. The wheel assembly according to claim 14, wherein the resolver assembly comprises, a base print board which is non-rotatably connected to the wheel shaft, a wheel print board which is non-

rotatably connected to the wheel; and a rim handle print board which is non-rotatably connected to the rim handle, and wherein the rim handle spokes or the connection assembly cover plate is provided with rim handle connection struts extend from a rim handle side of the wheel to an opposite, resolver assembly side of the wheel, wherein a rim handle print board carrier positioned at the resolver assembly side of the wheel is connected to the rim handle connection struts, wherein the rim handle print board is mounted on the rim handle print board carrier.

17. The wheel assembly according to claim 1, comprising: a brake disk which is releasably connected to the wheel hub, in particular to the hub cover plate.

18. The wheel assembly according to claim 17, wherein the resolver assembly comprises: a base print board which is non-rotatably connected to the wheel shaft; a wheel print board which is non-rotatably connected to the wheel; and a rim handle print board which is non-rotatably connected to the handle, a base print board ca tier which is rotatably fixed relative to the wheel shaft and on which the base print board is mounted, and a resolver assembly cover plate which is releasably connected to the wheel shaft and to which the base print board carrier is releasably connected, wherein the brake disk is mounted at a side of the resolver assembly cover plate which is opposite the resolver assembly, wherein a brake disk cover plate is mounted on the resolver assembly cover plate so as to form a brake disk chamber.

19. The wheel assembly according to claim 1, comprising: a wheel rim; a tire mounted on the wheel rim; a plurality of spokes which connect the wheel rim with the wheel hub.

20. The wheel assembly according to claim 1, further comprising: a variable power supply of which an output is connected to the power input of the hub motor; and an electronic controller having an input assembly to which the at least one resolver assembly output is connected and having an output which is connected to an input assembly of the variable power supply for controlling the output power of the power supply, wherein the electronic controller is configured for processing the wheel resolver signal and the rim handle resolver signal and to generate in dependence of at least those two signals a power supply control signal.

21. The wheel assembly according to claim 20, wherein the power supply control signal has a positive substantially linear relation with the power supplied by the variable power supply to the hub motor.

22. The wheel assembly according to claim 21, wherein the power supply control signal is dependent on the average difference between wheel resolver signal and the handle resolver signal during a number of sampling periods.

23. The wheel assembly according to claim 20, wherein the resolver assembly comprises: a base print board which is non-rotatably connected to the wheel shaft; a wheel print board which is non-rotatably connected to the wheel; and a rim handle print board which is non-rotatably connected to the rim handle, wherein the base print board comprises a first base print board coil track which is connectable to an electronic controller and which is configured for generating a first magnetic field, wherein the windings of the first base print board coil track are substantially concentric with the shaft axis, wherein the base print board comprises a second se print board coil track which is connectable to an electronic controller and which is configured for generating a second magnetic field, wherein the windings of the second base print board coil track are substantially concentric with the shaft axis, wherein the wheel print board comprises a wheel print board conductive track which is electrically closed and extends with a meandering pattern over a pitch circle (P**1**) which is concentric with the shaft axis and which has a first radius, wherein the base print board has at least one first base print board detection track which extends with a similar meandering pattern as the wheel print board conductive track over a pitch circle (P**1**′) which is concentric with the shaft axis and which also has the first radius, wherein the at least one first base print board detection track is connectable to an input assembly of an electronic controller, and wherein the electronic controller supplies an alternating current to the first base print coil track to generate the first magnetic field, which in turn generates an alternating current in the wheel print board conductive track, which in

turn generates a series of third magnetic fields around the meandering pattern of the wheel print board conductive track, which, in turn, generates an alternating current in the at least one first base print board detection track which is the wheel resolver signal.

24. The wheel assembly according to claim 20, wherein the resolver assembly comprises: a base print board which is non-rotatably connected to the wheel shaft; a wheel print board which is non-rotatably connected to the wheel; and a rim handle print board which is non-rotatably connected to the rim handle, wherein the base print board comprises a first base print board coil track which is connectable to an electronic controller and which is configured for generating a first magnetic field, wherein the windings of the first base print board coil track are substantially concentric with the shaft axis, wherein the base print board comprises a second base print board coil track which is connectable to an electronic controller and which is configured for generating a second magnetic field, wherein the windings of the second base print board coil track are substantially concentric with the shaft axis, wherein the rim handle print board comprises a rim handle print board conductive track which is electrically closed and extends with a meandering pattern over a pitch circle (P**2**) which is concentric with the shaft axis and which has a second radius, wherein the base print board has at least one second base print board detection track which extends with a similar meandering pattern as the rim handle plate conductive track over a pitch circle (P**2**′) which is concentric with the shaft axis and which also has a second radius, wherein at least one second base print board detection track is connectable to an input assembly of an electronic controller, and wherein the electronic controller supplies an alternating current to the second base print coil track to generate the second magnetic field, which in turn generates an alternating current in the rim handle print board conductive track, which in turn generates a series of fourth magnetic fields around the meandering pattern of the rim handle print board conductive track, which, in turn, generates an alternating current in the at least one second base print board detection track which is the rim handle resolver signal.

25. The wheel assembly according to claim 20, wherein the resolver assembly comprises: a base print board which is non-rotatably connected wheel shaft; a wheel print board which is non-rotatably connected to the wheel; and a rim handle print board which is non-rotatably connected to the rim handle, wherein the base print board comprises a first base print board coil track which is connectable to an electronic controller and which is configured for generating a first magnetic field, wherein the windings of the first base print board coil track are substantially concentric with the shaft axis, wherein the base print board comprises a second base print board coil track which is connectable to an electronic controller and which is configured for generating a second magnetic field, wherein the windings of the second base print board coil track are substantially concentric with the shaft axis, wherein the wheel print board comprises a wheel print board conductive track which is electrically closed and extends with a meandering pattern over a pitch circle (P**1**) which is concentric with the shaft axis and which has a first radius, wherein the base print board has at least one first base print board detection track which extends with a similar meandering pattern as the wheel print board conductive track over a pitch circle (P**1**′) which is concentric with the shaft axis and which also has the first radius, wherein the at least one first base print board detection track is connectable to an input assembly of an electronic controller, wherein the rim handle print board comprises a rim handle print board conductive track which is electrically closed and extends with a meandering pattern over a pitch circle (P**2**) which is concentric with the shaft axis and which has a second radius, wherein the base print board has at least one second base print board detection track which extends with a similar meandering pattern as the rim handle plate conductive track over a pitch circle (P**2**″) which is concentric with the shaft axis and which also has a second radius, wherein the at least one second base print board detection track is connectable to an input assembly of an electronic controller, and wherein the electronic controller supplies an alternating current to the first base print coil track to generate the first magnetic field, which in turn generates an alternating current in the wheel print board conductive track, which in turn generates a series of

third magnetic fields around the meandering pattern of the wheel print board conductive track, which, in turn, generates an alternating current in the at least one first base print board detection track which is the wheel resolver signal, wherein the first magnetic field additionally generates an alternating current in the rim handle print board conductive track, which in turn generates a series of fourth magnetic fields around the meandering pattern of the rim handle print board conductive track, which, in turn, generates an alternating current in the at least one second base print board detection track which is the rim handle resolver signal.

26. A wheelchair comprising the wheel assembly according to claim 1.