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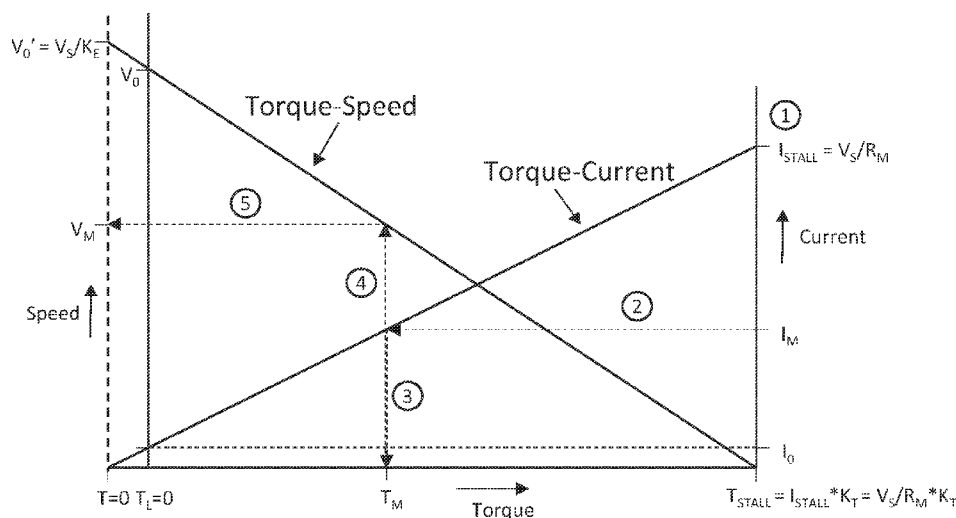


Fig. 2

(57) Abstract: The disclosure relates to an adjustment of a frame relative to a base from a first position to a user-preferred second position. An end stop is provided at an adjustment end position of the adjustment range. The adjustment includes driving the frame relative to the base from the first position towards the second position and estimating a positional parameter indicative of a traveled distance of the frame relative to the base with respect to the first position based on a model that includes a parameter indicative of an electrical motor impedance of the electrical motor. Prior to driving the frame, the frame is driven against the end stop, a stall current draw is measured, and an electrical motor impedance is estimated based on the measured stall current draw.



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Title: Device and method for adjusting a frame of an exterior vision unit for a vehicle relative to a base

5 FIELD

The invention relates to a method and device for adjusting a frame relative to a base, particularly a method and device for adjusting an exterior rear view mirror or camera of a vehicle.

10 BACKGROUND

Devices for adjusting vehicles components relative to each other are generally known. For example, exterior vision units for a vehicle, which typically include a vision element, such as a mirror, camera and/or display, generally include an adjustment device arranged for adjusting an
15 orientation of the vision element relative to the vehicle, about a horizontal and a vertical axis, such that a driver of the vehicle can fine-tune its rearward view. Some known adjustment devices are carried by a frame, wherein the frame is movable relative to a base between a first position and a second position. For exterior vision units, the first position may
20 correspond to a folded position, or park position, in which the frame substantially extends parallel to the vehicle, and the second position may correspond to an extended position in which the frame extends substantially outward from the vehicle.

The actuation between the first and second position is typically
25 performed by a dedicated actuator. For some conventional exterior vision units, actuation of the vision element about a horizontal axis is independent of actuation about a vertical axis, which is often referred to as the power fold actuation.

In some contemporary exterior vision units, however, the
30 adjustment of the vision element and the power fold actuation are coupled.

The adjustment device in such units may for example be arranged to, in addition to fine tuning an orientation of the vision element about two respective axes, drive the power fold actuation between the folded position and the extended position. Such adjustment devices may thus be regarded
5 as conventional adjustment devices with additional power fold capabilities, or alternatively as a multi-axis power fold actuator. An example of such device is for example described in EP3218226.

A downside of such contemporary arrangement is that a user-setting is lost each time a power fold actuation is performed, and that a user
10 may have to re-adjust the vision element after each power fold operation. Some exterior vision units therefore include a position sensor for measuring a position of the vision unit relative to the base and a memory for storing a desired adjustment position. When power folding to the extended position, the vision element can be automatically actuated to the stored adjustment
15 position. As a consequence, a dedicated sensor data communication channel may be required between the vision unit and a control module of the vision unit that is typically arranged in a door of the vehicle. This solution may however increase overall costs of the vehicle and may not always be available. Alternative sensorless arrangements are therefore proposed to
20 control a position of the vision unit relative to the vehicle based on ripple counting of a current draw signal of an electric motor that drives the vision unit. Using ripple counting methods for controlling the adjustment of the vision element is typically relatively data- and computational intensive

25 SUMMARY

It is an aim to provide an improved adjustment device for a vehicle. It is a particular object to provide an adjustment device that is capable of reliably and accurately adjust a vision element of an exterior vision unit for a vehicle. It is also an aim have the vision element adjust the vision with
30 minimal data- and power- and computational intensive components. At any

rate, it is an object to at least provide a useful adjusting device and method to the art.

According to a first aspect, a method is provided for adjusting a frame relative to a base, wherein the frame is connected to the base and
5 movably drivable relative to the base from a first position to a user-preferred second position by means of an electric motor, wherein an end stop is provided at an adjustment end position of the adjustment range for blocking a movement of the frame relative to the base beyond the adjustment range. The method comprises having the electric motor drive the
10 frame relative to the base from the first position towards the second position and estimating a positional parameter indicative of a traveled distance of the frame relative to the base with respect to the first position based on a model that includes a parameter indicative of an electrical motor impedance of the electrical motor. Prior to having the electric motor drive the frame
15 relative to the base to from the first position towards the second position, the method includes having the electric motor drive the frame against the end stop, measuring a stall current draw of the electric motor therefrom, and estimating the electrical motor impedance based on the measured stall current draw. The electrical motor impedance may not be constant, but can
20 vary depending for example on temperature of the electric motor or its age, particularly of the windings of the electric motor and the brushes respectively. Having a precise and accurate estimate of the electrical motor impedance can greatly improve the accuracy of the adjustment of the frame to the second position, particularly when no dedicated position or speed
25 sensor is used for measuring the position of the frame. A temperature measurement may be optionally be obtained from a temperature sensor of the vehicle for adapting the electric motor impedance parameter, however such temperature measurement may often not be representative of the temperature of the electric motor because, in practice, the temperature
30 sensor of the vehicle is located remote from the electric motor.

The model parameter indicative of the electrical motor impedance is therefore estimated on a measured stall current obtained by driving the frame against the end stop, and preferably not based on a sensor measurement of a temperature.

5 The adjustment of the frame to the user-preferred second position in accordance with the first aspect may be in a setting step, in which a user sets the frame in accordance with its preference. The adjustment of the frame to the user-preferred second position in accordance with the first aspect may additionally or alternatively be in a non-setting step, in which
10 the user-preferred second position has already been preset by the user. In the non-setting step, the frame may be automatically adjusted to arrive at the second position without requiring input from the user.

 Optionally, the method comprises a setting step that includes estimating a distance parameter based on the model indicative of a distance
15 between the first position and the user-preferred second position, and a non-setting step that includes having the electric motor drive the frame relative to the base from the first position towards the second position, based on the model estimating the positional parameter indicative of the traveled distance of the frame relative to the base with respect to the first position,
20 and terminating the driving of the frame relative to the base in case the positional parameter substantially corresponds to the distance parameter. The setting step accordingly allows the user to set frame in a preferred position relative to the base, by controlling the electric motor. Once the second position has been determined accordingly, the non-setting step
25 enables to automatically adjust the frame to the user predefined second position without requiring a dedicated position sensor or speed sensor.

 More general, a second aspect provides a method for adjusting a frame relative to a base, wherein the frame is connected to the base and movably drivable relative to the base from a first position to a user-
30 preferred second position by means of an electric motor. The method

comprises, e.g. in a setting step, estimating a distance parameter indicative of a distance between the first position and the second position based on a model. The method particularly comprises, e.g. in the setting step, having a user control the electric motor to drive the frame relative to the base to the user-preferred second position, and having the electric motor drive the frame from the user-preferred second position to the first position while estimating the distance parameter from said driving to the first position.

The user-adjustment of the frame to the set the frame in the preferred second position may in practice be intermittently or include back-and-forth adjustments of the frame relative to the base. Although the distance parameter can be estimated from the user-adjustment to set the second position, e.g. accounting for the back-and-forth adjustments, this approach would make the estimation of the distance parameter cumbersome and unreliable. Therefore, according to this method, the distance parameter is determined based on the driving of the frame from the user-predefined second position to the first position. This movement can be made substantially continuous to obtain an accurate estimation of the distance between the user-preferred second position and the first position. The frame can for example return by default to the first position each time the vehicle is locked, as is often preprogrammed for contemporary vehicles. The distance parameter can hence be determined from this default adjustment action. The frame can at a later instant be automatically returned to the second position as previously set by the user when the vehicle is unlocked, without the need for a dedicated position or speed sensor. The distance parameter can for instance be stored in a memory for later use.

Once the distance parameter has been estimated, the frame can be automatically adjusted to arrive at the second position. The method hence optionally further comprises, e.g. in a non-setting step, having the electric motor drive the frame relative to the base from the first position towards the second position, based on the model estimating a positional parameter

indicative of a traveled distance of the frame relative to the base with respect to the first position, and terminating the driving of the frame relative to the base in case the positional parameter substantially corresponds to the distance parameter.

5 Optionally, the method comprises compensating the estimated distance parameter and/or the estimated positional parameter for a difference between a driving direction of the frame from the second position towards the first position and a driving direction of the frame from the first position towards the second position. The driving of the frame in its
10 adjustment range may show different characteristics for its different driving directions. As the estimation of the distance parameter may be associated with a driving direction opposite to a driving direction associated with the estimation of the positional parameter, any of said estimates may be compensated to allow for even comparison. The distance parameter or the
15 positional parameter may for example be adapted by a compensation factor.

 Optionally, the difference is determined by having the electromotor drive the frame relative to the base by a known reference distance in two opposing driving directions. The driving of the frame between two known reference points, e.g. between two predetermined end stops, in opposite
20 driving directions can be used to calibrate the estimation and account for asymmetry-induced estimation errors.

 Optionally, the distance parameter and/or the positional parameter is estimated based on a measured current draw of the electric motor. More particular, the distance parameter is optionally estimated based on a
25 measured cumulative current draw of the electric motor over time associated with the driving of the frame from the first position to the second position.

 Optionally, the distance parameter and/or the positional parameter is estimated based on a predetermined and/or measured supply voltage to
30 the electric motor.

Optionally, the distance parameter is estimated by integrating an instantaneous motor speed of the electric motor over time, the instantaneous motor speed being estimated based on an instantaneous motor torque of the electric motor, the instantaneous motor torque being
5 estimated based on the measured instantaneous current draw of the electric motor, e.g. given a predetermined and/or measured supply voltage to the electric motor. The electrical impedance of the electric motor and the stall current draw of the electric motor can be used, in combination with a known or measured supply voltage, for obtaining a relation between current draw
10 of the electric motor and motor torque of the electric motor. A relation between the motor torque and motor speed of the electric motor may also be known, and can be combined with the relation between the motor current draw and the motor torque to obtain a mapping between the instantaneous current draw of the instantaneous motor torque. Based on the
15 instantaneous current draw of the electric motor over time, a position of the motor and hence of the frame can be determined, without requiring a dedicated position sensor.

Optionally, the method does not include measuring a position parameter indicative of a position of the frame relative to the base, nor
20 measuring a speed parameter indicative of a speed of the frame relative to the base, nor measuring a torque parameter indicative of a motor torque of the electric motor. No dedicated position sensor, speed sensor or torque sensor may hence be needed.

Optionally, the method comprises estimating a back-EMF constant
25 of the electric motor based on the estimated electrical motor impedance. The back-EMF constant is in practice generally provided by the manufacturer of the electric motor, but may gradually change over time. The back-EMF constant may therefore be estimated, e.g. periodically, for obtaining accurate estimations of the distance and positional parameters.

Optionally, the estimating of the back-EMF constant includes having the electric motor drive the frame relative to the base by a known reference distance, estimating a positional parameter indicative of a traveled distance of the frame relative to the base, and estimating or
5 adapting the back-EMF constant based on a dissimilarity between the known reference distance and the travelled distance. The known reference distance may for example be the predetermined distance between two end stops delimiting the adjustment range of the frame.

According to a third aspect, a method is provided for adjusting a
10 frame relative to a base, wherein the frame is connected to the base and movably drivable relative to the base from a first position to a second position by means of an electric motor. The method comprises: determining an indication of effort for the electric motor to drive the frame relative to the base from the first position to arrive at the second position; having the
15 electric motor drive the frame relative to the base from the first position towards the second position with an effort in accordance with the determined indication of effort for arriving at the second position.

The indication of effort for the electric motor to drive the frame relative to the base may be expressed in terms of an amount of activity,
20 labor, or exertion that is expected to be required for accomplishing the task of adjusting the frame from the first position to arrive at the second position, such as how much time is anticipated for the electric motor to drive the frame between the first position and the second position, and/or how much electric current, energy and/or power is anticipated to be consumed by
25 the electric motor for it to drive the frame between the first position to the second position. Hence, the indication of effort for the electric motor to drive the frame relative to the base from the first position to arrive at the second position accordingly defines to the expected amount of work needed for achieving the task of adjustment the frame from the first position to the
30 second position.

It will be appreciated that, as the driving of the frame by the electric motor is in accordance with the determined indication of effort, the indication of effort is accordingly determined prior to the driving of the frame by the electric motor. Said indication of effort may for example be stored in a memory. The method may hence include determining the indication of effort for the electric motor to drive the frame relative to the base from the first position to arrive at the second position; optionally storing said indication of effort in a memory; and after having determined said indication of effort, having the electric motor drive the frame relative to the base from the first position towards the second position with an effort in accordance with the determined indication of effort for arriving at the second position. Hence, for example, the indication of effort for the electric motor to drive the frame relative to the base from the first position to arrive at the second position may for example be determined at a first time, and the driving, by the electric motor, of the frame relative to the base from the first position towards the second position with an effort in accordance with the determined indication of effort for arriving at the second position may be executed at a second, later, time.

It will be appreciated that the indication of effort for the electric motor to drive the frame relative to the base from the first position to arrive at the second position concerns an indicator, e.g. an estimate or measurement, of a 'true' effort for the electric motor to have the frame exactly arrive at the second position. The indication of effort may in practice however not be identical to a 'true' effort. It will therefore also be appreciated in this regard that the effort by which the electric motor drives the frame relative to the base from the first position toward the second position, which corresponds to the determined indication of effort, may in practice not cause the frame to arrive exactly at the second position, for example due to inaccuracies in the determining of the indication of effort, and due to external factors that have changed since the determining of the

indication of effort. The method however aims to accurately determine the indication of effort for having the motor drive the frame from the first position toward the second position so as to have it arrive accurately at the second position.

5 The base and the frame may each be mounted to or be part of a vehicle or a part thereof. It will be appreciated that the method and device described herein may be applied for adjusting various vehicle components relative to each other, including but not limited to adjustment of seat components relative to the vehicle and relative to each other, adjustment of
10 a steering wheel orientation relative to the vehicle, adjustment of air flaps relative to the vehicle, adjustment of a spoiler position and orientation relative to the vehicle, adjustment of head and tail lighting direction relative to the vehicle, adjustment of a seat belt anchor position relative to the vehicle, adjustment of an orientation of interior and exterior vision units
15 relative to the vehicle, adjustment of a fuel or charge port flap relative to the vehicle, adjustment of a valve in a battery cooling system, etc. It also will be appreciated that the adjustment may involve a rotation, a linear translation, or combinations thereof.

 The first, second and/or third aspects may particularly provide a
20 method for adjusting an external vision unit for a vehicle. The adjusting device for example includes a base for coupling to the vehicle, a frame connected to the base and pivotably drivable relative to the base from a first position to a second position, and an electric motor arranged for pivotally driving the frame relative to the base. The method comprises, e.g. in a
25 setting step, estimating a distance parameter indicative of a distance between the first position and the second position based on a model. The method particularly comprises, e.g. in the setting step, having a user control the electric motor to drive the frame relative to the base to the user-preferred second position, and having the electric motor drive the frame
30 from the user-preferred second position to the first position while estimating

the distance parameter from said driving to the first position. The method additionally or alternatively comprises having the electric motor drive the frame relative to the base from the first position towards the second position and estimating a positional parameter indicative of a traveled distance of the frame relative to the base with respect to the first position based on a model that includes a parameter indicative of an electrical motor impedance of the electrical motor. Prior to having the electric motor drive the frame relative to the base to from the first position towards the second position, the method includes having the electric motor drive the frame against the end stop, measuring a stall current draw of the electric motor therefrom, and estimating the electrical motor impedance based on the measured stall current draw.

Hence, the frame may be adjusted relative to the base in a computationally efficient manner, without requiring a position or speed sensor for measuring a position or speed of the electric motor output or the frame. The method enables an accurate and reliable adjustment of the exterior vision unit, without requiring a position or speed sensor, nor computational heavy ripple counting methodologies. The exterior vision unit may hence be used in conjunction with door control modules that do not support sensor data communication. Also, the method may be used in combination with a position or speed sensor, preferably with relatively low data transmission rates, for improving the adjustment accuracy and adding redundancy to the adjustment system.

The adjustment of the frame relative to the base may be about a vertical axis, or power fold axis. The adjustment of the frame relative to the base may also be about a horizontal axis. It will be appreciated that the adjustment may additionally or alternatively involve a linear translation.

Optionally, the method comprises adjusting the frame relative to the base about a vertical and/or a horizontal axis.

Optionally, the frame is adjustable within an adjustment range that extends between two opposing adjustment end positions. At one or both of the adjustment end positions, for example, a physical end stop may be provided to prevent adjustment of the frame beyond the adjustment end position.

Optionally, the first position corresponds to an adjustment end position of the adjustment range, and the second position corresponds to a position within the adjustment range between the opposing adjustment end positions. The adjustment end position may be a reference point for the adjustment of the frame.

Optionally, the frame is part of an external vision unit for a vehicle.

Optionally, the first position corresponds to a park position in which the frame extends substantially parallel to the vehicle and the second position corresponds to a drive position in which the frame extends substantially outward from the vehicle.

Optionally, the adjustment range includes a first adjustment end position associated with the park position, and a second adjustment end position, opposite the first adjustment end position, in which the frame, with respect to the second position, substantially over-extends outward from the vehicle.

Optionally, the first position corresponds to the first adjustment end position. The frame can hence be adjusted from the park position at the end of the adjustment range, to the drive position anywhere within the adjustment range. Optionally, the first position corresponds to the second adjustment end position. The frame can hence be adjusted from the relatively over-extended position at the end of the adjustment range to the drive position anywhere within the adjustment range. The travel distance from the over-extended position to the drive position may be a shorter than the travel distance from the park position to the drive position. Hence,

adjustment from the over-extended position may be more accurate than adjustment from the park position, as the contributions of systematic errors may be minimal. When in the park position at the first adjustment end position, the frame may for example be driven to the second adjustment end position beyond the second, drive, position, after which the frame is driven in reverse direction from the second adjustment end position to the second, drive, position, e.g. based on the indication of effort.

Optionally, the method comprises adjusting the frame relative to the base about a horizontal axis, wherein the first position corresponds to a park position in which the frame is in a first horizontal pivot position and the second position corresponds to a drive position in which the frame is in a second, different, horizontal pivot position. The park position may be such that a width of the vehicle is minimized.

Optionally, the first horizontal pivot position is a relatively down-pivoted position and the second horizontal pivot position is a relatively upward-pivoted position, or vice versa.

Optionally, the electric motor is a DC-motor, particularly a low-power DC-motor, e.g. with a power rating in a range of between 1 and 100 Watt, such as in a range of 0.5-50 Watt, or in a range of 1-20 Watt.

Optionally, the indication of effort is determined based on a previous effort of the electric motor driving the frame relative to the base. For example, a user may have the electric motor drive the frame relative to the base between any two positions, wherein one or more effort parameters associated with the driving are measured and stored. The user may for example drive the frame from the first position to the second position in a first use. The one or more effort parameters may provide the indication of effort it takes for the electric motor to drive the frame, e.g. between the first and the second position. In a next use, the electric motor can output an effort based on the indication of effort, so as to adjust the frame to a desired position. For example, the one or more effort parameters may be measured

when the electric motor drives the frame from the second position to the first position, and/or vice versa. It may for example be determined how long it takes for the electric motor to drive the frame between the first position and the second position, and/or how much electric energy or power is
5 consumed for driving the frame between the first position to the second position.

Optionally, the indication of effort is determined based on the previous effort of the electric motor driving the frame relative to the base from the first position to arrive at the second position and/or from the
10 second position to arrive at the first position.

Optionally, the method comprises having a user control the electric motor to drive the frame relative to the base, e.g. to the second position, and determining the indication of effort therefrom.

Optionally, the method comprises having a user control the electric
15 motor to drive the frame relative to the base from any position to the second position, and determining the indication of effort therefrom.

Optionally, the method comprises having a user control the electric motor to drive the frame relative to the base from the first position to the second position, and/or vice versa, and determining the indication of effort
20 therefrom.

Optionally, the method comprises storing the determined indication of effort in a memory.

Optionally, the method comprises measuring one or more effort parameters, particularly including one or more of a power consumption of
25 the electric motor, a time duration of the powering of the electric motor, an electric current draw of the electric motor, a supply voltage to the electric motor. The exterior vision unit may hence comprise, e.g. only, one or more of a time sensor, a voltage sensor and an electric current sensor. Hence, the method may for example include, in a first instant, powering the electric
30 motor to drive the frame relative to the base from the first position to the

second position or vice versa while measuring a time duration of the powering of the electric motor, and, in a second instant, powering the electric motor with a time duration corresponding to the measured time duration to drive the frame relative to the base from the first position to arrive at or near the second position.

Optionally, the method does not include measuring a position parameter indicative of a position of the frame relative to the base, nor measuring a speed parameter indicative of a speed of the frame relative to the base, nor measuring a torque parameter indicative of a motor torque of the electric motor. Hence, the one or more measured effort parameters may not include a measured position parameter indicative of a position of the frame relative to the base, a measured speed parameter indicative of a speed of the frame relative to the base, nor a measured torque parameter indicative of a motor torque of the electric motor.

Optionally, the method further comprises measuring one or more of a position parameter indicative of a position of the frame relative to the base, a speed parameter indicative of a speed of the frame relative to the base, and a torque parameter indicative of a motor torque of the electric motor, and controlling the electric motor based on the measured position parameter, speed parameter and/or torque parameter. Hence, for redundancy and/or improved accuracy, the adjustment can be controlled based on an indication of effort in addition to the measured position parameter, speed parameter and/or torque parameter.

Optionally, the method comprises estimating one or more effort parameters. The one or more estimated effort parameters are optionally estimated based on the one or more measured effort parameters.

Optionally, the method comprises estimating a distance parameter indicative of a distance between the first position and the second position. A user may adjust the frame in a first use to a desired second position, wherein a positional parameter indicative of a position of the frame relative

to the base is estimated while adjusting the frame. The positional parameter associated with the second position may for example be stored. The positional parameter may be estimated based on a model of the exterior vision unit, for example having the measured electric current draw over
5 time and/or supply voltage over time as input variables. The distance parameter may be representative of the positional parameter associated with the second position.

Optionally, the method comprises, while having the electric motor drive the frame relative to the base from the first position towards the
10 second position, measuring one or more effort parameters and estimating, based on the measured effort parameters, a positional parameter indicative of a traveled distance of the frame relative to the base with respect to the first position and/or the second position. The positional parameter may be estimated based on a model of the exterior vision unit, for example having
15 the measured electric current draw and supply voltage as input variables.

Optionally, the method comprises having the electric motor terminate the driving of the frame relative to the base in case the estimated traveled distance of the frame substantially corresponds to the estimated distance between the first position and the second position.

20 Optionally, the positional parameter is estimated based on a measured electric current draw of the electric motor.

Optionally, the positional parameter is estimated based on a measured supply voltage to the electric motor.

Optionally, the estimating of the positional parameter includes
25 estimating a motor torque of the electric motor based the measured electric current draw of the electric motor, estimating a motor speed of the electric motor based on the estimated motor torque, and estimating the positional parameter based on the estimated motor speed. The measured current draw at a time instant may be used to determine the motor torque at that time
30 instant. The determined motor torque at the time instant may in turn be

used for determining the motor speed at the time instant. The positional parameter may be determined by integrating the motor speed over a plurality of time instants. Hence, the adjustment of the frame relative to the base can be accurately made independent of variable circumstances at the
5 time of the adjustment, such as a, e.g. temperature, variable friction, inclination of and adjustment axis.

Optionally, a predefined detectable reference position is provided in a motion range of the frame between the first position and the second position, wherein the predefined detectable reference position is particularly
10 formed by a protuberance and/or indentation for being encountered by the frame when pivotally driven between the first position and the second position.

Optionally, the method comprises detecting that the frame is driven past the predefined reference position and adjusting the estimated
15 positional parameter based on the detection of the predefined reference position. When the frame is driven over the reference position, across the protuberance and/or indentation, a perturbation in the motor current draw signal can for instance be detected. From the motor current draw signal, it can hence be detected if the frame is at the reference position or has crossed
20 the reference position. The predefined reference point can be used for increasing the accuracy of the estimated positional parameter estimation.

Optionally, the method comprises estimating an electrical motor impedance of the electric motor based on the one or more measured effort parameters, particularly based on a measured supply voltage and a
25 measured stall current draw of the electric motor, wherein estimating of the positional parameter is based on the estimated electrical motor impedance. The motor impedance may be used in a model for determining the positional parameter. The motor impedance may however vary over time, and may therefore be estimated regularly.

Optionally, the method comprises estimating a back-EMF constant of the electric motor based on the one or more measured effort parameters, wherein estimating of the positional parameter is based on the estimated electrical motor impedance.

5 Optionally, a first end stop is provided at a first adjustment end position of an adjustment range for blocking a movement of the frame relative to the base beyond the first adjustment end position. The first position may correspond to the first adjustment end position, such that the first position could be a fixed and known reference position.

10 Optionally, a second end stop is provided at a second adjustment end position of the adjustment range opposite the first adjustment end position for blocking a movement of the frame relative to the base beyond the second adjustment end position. The second position may hence be in an adjustment range between the first and the second end stops. The end stops
15 may be provide as a physically boundary to the adjustment range of the frame relative to the base.

 Optionally, the method comprises having the electric motor drive the frame against the first or second end stop, measuring a supply voltage and a stall current draw of the electric motor therefrom, and estimating the
20 electrical motor impedance based on the measured supply voltage and the stall current draw.

 Optionally, the method comprises prior to having the electric motor drive the frame relative to the base from the first position to the second position, having the electric motor drive the frame relative to the base
25 against the first or second end stop, measuring a supply voltage and a stall current draw of the electric motor therefrom, and estimating the electrical motor impedance based on the measured supply voltage and the stall current draw. Hence, the motor impedance may be estimated prior to the driving of the frame to the second position, for improving accuracy of the
30 adjustment to the second position that may be based, in part, on the

estimated motor impedance. Shortly after having estimated the motor impedance, the motor may drive the frame to the second position, e.g. by inverting a polarity of the supply voltage to the motor.

Optionally, the method comprises having the electric motor drive
5 the frame relative to the base from the second position to the first position until it is detected that the frame has arrived at the first position and is driven against the first or second end stop, wherein said detection includes detecting that a current draw of the electric motor exceeds a predetermined threshold. Hence, the motor impedance can be estimated for improving
10 accuracy for when the motor drives the frame back to the second position.

A fourth aspect provides an adjustment device, particularly for an exterior vision unit for a vehicle. The adjustment device comprises a base, e.g. for coupling to the vehicle, a frame connected to the base, and movably drivable relative to the base from a first position to a second position, an
15 electric motor arranged for driving the frame relative to the base, and a controller configured for controlling the electric motor. The controller is configured for executing a method as described herein. Hence, the controller is configured for controlling the electric motor to drive the frame relative to the base from the first position towards the second position and estimating a
20 positional parameter indicative of a traveled distance of the frame relative to the base with respect to the first position based on a model that includes a parameter indicative of an electrical motor impedance of the electrical motor. Also, the controller may be configured for controlling the electric motor to drive the frame against the end stop, obtaining a measurement of a
25 stall current draw of the electric motor, and estimating the electrical motor impedance based on the measured stall current draw. Also, the controller may be configured for, e.g. in a setting step, estimating a distance parameter indicative of a distance between the first position and the second position based on a model. Particularly, e.g. in the setting step, the
30 controller may allow a user to control the electric motor to drive the frame

relative to the base to the user-preferred second position, and, e.g. at a later time instant, controlling the electric motor to drive the frame from the user-preferred second position to the first position while estimating the distance parameter from said driving to the first position.

5 Optionally, the controller comprises or is operatively connected to a memory.

 Optionally, the memory stores a plurality of user-specific second positions, wherein the controller is configured for driving the frame relative to the base to a respective one of the plurality of user-specific second
10 positions in dependence of a user identifier signal indicative of a user of the vehicle. The user identifier signal may for example be generated when a person unlocks the vehicle with its personal key. The user identifier signal may for example be transmitted over a communication network of the vehicle. The memory may for example store a lookup table which links
15 identifier signals to respective personalized second positions for the adjustment device.

 Optionally, the memory is remote from the vehicle. The plurality of user-specific second positions may hence be stored at a location remote from the vehicle. The vehicle may for example wirelessly communicate the
20 identifier signal to the remote location, wherein, in response, the associated user-specific second position may be wirelessly communicated to the vehicle, for having the controller in the vehicle control the electric motor accordingly. The memory may for example be held by portable device of the user, such as a smartphone, or the user's personal key or keychain.

25 Optionally, the memory stores a plurality of vehicle-specific indications of effort and/or a reference indication of effort for a reference vehicle and a converter for converting the reference indication of effort to a vehicle-specific indication of effort, wherein the controller is configured for driving the frame relative to the base to the, e.g. user-specific, second

position based on the vehicle-specific indication of effort in dependence of a vehicle identifier signal indicative of the type of vehicle.

A fifth aspect provides an exterior vision unit for a vehicle, comprising an exterior vision element, such as a mirror, camera and/or display, and an adjustment device as described herein for adjusting the exterior vision element relative to the vehicle.

It will be appreciated that any of the aspects, features and options described herein can be combined. It will particularly be appreciated that any of the aspects, features and options described in view of the method apply equally to the adjustment device, and vice versa.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described in detail with reference to the accompanying drawings in which:

Figure 1 shows an example of an exterior vision unit for a vehicle; and

Figure 2 shows a graphical example of a method for estimating an positional parameter.

DETAILED DESCRIPTION

Figure 1 shows an example of an adjustment device 44, here for an external vision unit. The device 44 comprises a base 74, which is here arranged to be mounted to the body of a motor vehicle, such as a car. A frame 46, 48 is pivotably arranged about the base 74, about a first pivot axis 50. While the adjustment device 44 is here described in view of an external vision unit, for example for pivotally adjusting the external vision unit between a folded, park, position and an extended, drive, position, it will be

appreciated that the adjustment device may also be applied for adjusting other components, e.g. translationally and/or pivotally, particularly vehicle components such as a seat, a steering wheel, a head rest, air diverting flaps, external spoilers, and others.

5 In this example the frame comprises a first frame part 46 and a second frame part 48. The second frame part 48 is pivotable about the first pivot axis 50. The first frame part 46 is movably coupled to the second frame part 48. More specific, the first frame part 46 is in this example pivotable relative to the second frame part 48 about a second pivot axis 52. The first
10 frame part 46 is pivotable along with the second frame part 48 about the first pivot axis 50.

 The frame 46, 48 may for example include, or be coupled to, a shell-shaped cover for covering a vision element such as a mirror, camera, LIDAR and/or display. The shell-shaped cover may particularly be integrally formed
15 with the first frame part 46. The vision element can be coupled to the frame 46, 48 for being adjusted about the first and second pivot axes 50, 52. The vision element may particularly be coupled to the second frame part 46. The vision element may for example be integrated with the shell-shaped cover.

 With respect to adjustment about the first axis 50, the adjustment
20 device 44 is movable between a first position, or folded position or park position, in which the frame 46, 48 substantially extends parallel to the vehicle, and a second position, or drive position or extended position, in which the frame 46, 48 extends substantially outward from the vehicle. Figure 1 shows the adjustment device in the second position. The
25 adjustment device can be moved between the first and the second position by pivoting the frame 46, 48 relative to the base 74 about the first pivot axis 50. The frame 46, 48 may also be pivoted about the second axis 52, e.g. also between a respective first and second position.

 The second position is adaptable by a user, so as to optimize his or
30 her rearward view. The second position may hence be variable and user-

specific. The first position may be a fixed position, and may for instance include a hard stop. The first position may therefore be used as a reference position.

In the adjustment device 44 in this example comprises two
5 electromotors, namely a first electromotor and a second electromotor 200. The electromotors and are omitted from figure 1 for clarity. A first drivetrain 23 for the first electromotor, comprising one or more gears 34, is provided for pivoting the frame 46, 48 relative to the base about the first pivot axis 50. A second drivetrain 25 for the second electromotor, comprising
10 one or more gears 26, is provided for pivoting the first frame part 46 relative to the second frame part 48, about the second pivot axis 52. The first drivetrain 23 and the second drivetrain 25 are in this example separate from each other.

The adjustment of the frame 46, 48 relative to the base 74 will be
15 described in view of an adjustment about the first axis 50. It will be appreciated that the same or similar principle can apply to the adjustment about the second axis 52.

For pivotally driving the frame 46, 48 about the first axis 50, to the second position, particularly to the second position as preset by a user, an
20 indication of effort can be determined for the first electric motor to pivot the frame 46, 48 relative to the base 47 from the first position to arrive at the second position. Based on the determined indication of effort, the first electromotor may be powered so as have the frame arrive at the second position. The indication of effort may be expressed in terms of power or
25 energy demand, such as electric power demand, distance to cover, required actuation time, etc. The indication of effort may be determined in various ways. The indication of effort may for example be determined from a previous pivot action. For example, a user may set the frame in the second position of his preference, for example in a first use of the exterior vision
30 unit. While pivotally driving the frame, e.g. from the first position, to the

second position, one or more effort parameters may be measured. The measured effort parameters may for example include a power consumption of the motor, a current draw of the motor, a supply voltage of the motor. The measured effort may also include a time duration of the adjustment to
5 arrive at the second position. It will be appreciated that the external vision unit preferably lacks a position sensor and a speed sensor that measure a position and speed of the frame directly.

The indication of effort may also be determined while the frame is pivoted back from the user-set second position to the first position. For
10 example, the first position may be at an adjustment end of an adjustment range of the frame, optionally provided an end stop to block movement of the frame beyond the adjustment end position. It may be detected from the current draw of the motor if the frame hits the end stop, indicating that the end of the adjustment range has been reached, hence indicating that the
15 first position has been reached. It may for example be measured how long it takes and/or how much electric energy is consumed for the first electromotor to drive the frame from the second position to the first position. This time duration and/or energy consumption may be stored in a memory. When the frame is to be pivoted from the first position to the second position, e.g. in a
20 next use of the vehicle, the electromotor may be powered by the same time duration and/or power as stored in the memory, but in opposite direction, to have the frame arrive at the second position as preset by the user. The indication of effort may optionally account for temperature variations. The time and/or energy consumption of the electric motor may hence be
25 compensated depending on a temperature measurement of the exterior environment of the vehicle.

The frame is in this example adjustable within an adjustment range that extends between a first adjustment end position and a second adjustment end position. Here, a first end stop is provided at the first
30 adjustment end position, and a second end stop is provided at the second

adjustment end position. The first position may be associated with the first adjustment end position or the second adjustment end position, such that the first position can be a known starting and/or end position for the adjustment. The second position may be anywhere within the adjustment range between the first and second adjustment end positions. The first
5 adjustment end position may for example be associated with the park position, while the second adjustment end position may be a position beyond the second position. The frame in the second adjustment end position may for example extend substantially outward from the vehicle, in a slightly
10 more over-extended orientation compared to frame in the second position.

While the first position in these examples refers to the frame 46, 48 in the first adjustment end position, here corresponding to the park position, the first position may also refer the frame 46, 48 in the second adjustment end position. The second adjustment end position may be physically closer
15 to the second position than the first adjustment end position, here associated with the park position. Hence, if in the park position, and commanded to move to the second position, the frame may be pivotally driven beyond the second position to the second adjustment end position until the frame hits the second end stop, and if it has been detected that the
20 frame is at the second adjustment end position, the frame may be driven in reverse back to the second position. Similarly, if in the second position, and commanded to move to the park position, the frame may be pivotally driven to the second adjustment end position until the frame hits the second end stop, and if it has been detected that the frame is at the second adjustment
25 end position, the frame may be driven in reverse back via the second position to the park position. It will be appreciated that the frame 46, 48 may alternatively be driven directly from the second position back to the park position. The indication of effort as described herein may hence relate to the effort required for pivoting the frame 46, 48 from the second
30 adjustment end position to the second position. The second adjustment end

position and the second position may relatively close to each other, such that adjusting with respect to the second adjustment end position may be more accurate than adjusting with respect to the first adjustment end position, e.g. as effects of systematic errors may be minimized.

5 The method may involve an estimation of one or more effort parameters, e.g. based on the measured effort parameters such as current draw, supply voltage and time. The method may for example involve an estimation of a positional parameter indicative of a position of the frame relative to the base. The positional parameter estimation may be based on a
10 mathematical model mapping the measured current draw of the electric motor to the output speed of the electric motor. The estimated motor output speed may be integrated over time to obtain the positional parameter estimate.

 Figure 2 shows a graphical example of a method for estimating the
15 positional parameter from a measured current draw of the electric motor, here being a DC-motor. When the electric motor is powered, the motor supply voltage (V_s) and motor current draw (I_m) are sampled. Motor no-load current (I_0), motor no-load speed (V_0), motor torque constant (K_t) and motor Back-EMF constant (K_e) are a priori known constants of the electric motor.
20 In initial value of the electrical motor impedance (R_m) is also generally also known, and can also be determined, e.g. adapted, as described further below. With these parameters, a relation between instantaneous motor torque (T_m) and instantaneous motor current draw (I_m) can be determined, as visualized by the Torque-current function in figure 2. Additionally, a
25 relation between instantaneous motor torque (T_m) and instantaneous motor speed (V_m) can be determined, as visualized by the Torque-Speed function in figure 2.

 At a certain time instant, an instantaneous motor torque load (T_m) of the motor can be derived from the measured instantaneous motor current
30 draw (I_m) using a Torque-Current function of the electric motor. From the

instantaneous motor torque load (T_m), an instantaneous motor speed (V_m) can be derived using the Torque-Speed function. The instantaneous motor speed (V_m) estimates can be integrated over time, to obtain an estimate of a positional parameter that is indicative of a position of the frame relative to the base. The integration of the motor speed (V_m) may account for drive-direction changes of the electric motor, by taking the voltage polarity with which the motor is powered into account.

The Torque-Current function may be determined theoretically, but may also be determined or fine-tuned experimentally. For the experimental determination of the Torque-Current function, a stall current (I_{stall}) can be measured by having the motor drive against an end stop, e.g. the first end stop and the second end stop.. From the stall current (I_{stall}), the motor impedance (R_m) could be calculated.

The stall current (I_{stall}) may be measured regularly. The electric motor may for example drive the frame against an end stop each time a user commands the frame to move from the first to the second position. Additionally or alternatively, the electric motor may for example drive the frame against an end stop each time a user commands the frame to move from the second to the first position.

The estimation of the positional parameter may be used for estimating a distance between the first position and the second position. The indication of effort may hence be expressed in terms of the estimated distance between the first position and the second position.

The back-EMF constant (K_e) may also be adapted experimentally, e.g. less relevant than the electrical motor impedance (R_m). The back-EMF constant (K_e) may for instance be determined by having the motor drive the frame relative to the base between the two end stops, which define a fixed predetermined distance between them. This known distance can be compared with the estimated distance estimated by the method described herein. A discrepancy between the known distance and the estimated

distance can be attributed to an incorrect back-EMF constant (K_e), which can be adapted accordingly.

Alternatively, or additionally, the motor impedance (R_m) could be adapted by having the motor drive the frame relative to the base between
5 the two end stops, which define a fixed predetermined distance between them. This known distance can be compared with the estimated distance estimated by the method described herein. A discrepancy between the known distance and the estimated distance can be attributed to an incorrect electrical motor impedance (R_m), which can be adapted accordingly.

10 Herein, the invention is described with reference to specific examples of embodiments of the invention. It will, however, be evident that various modifications and changes may be made therein, without departing from the essence of the invention. For the purpose of clarity and a concise description features are described herein as part of the same or separate
15 embodiments, however, alternative embodiments having combinations of all or some of the features described in these separate embodiments are also envisaged.

However, other modifications, variations, and alternatives are also possible. The specifications, drawings and examples are, accordingly, to be
20 regarded in an illustrative sense rather than in a restrictive sense.

In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word 'comprising' does not exclude the presence of other features or steps than those listed in a claim. Furthermore, the words 'a' and 'an' shall not be construed as limited to 'only
25 one', but instead are used to mean 'at least one', and do not exclude a plurality. The mere fact that certain measures are recited in mutually different claims does not indicate that a combination of these measures cannot be used to an advantage.

Claims

1. A method for adjusting a frame relative to a base, wherein the frame is connected to the base and movably drivable relative to the base from a first position to a user-preferred second position by means of an electric motor, wherein an end stop is provided at an adjustment end
5 position of the adjustment range for blocking a movement of the frame relative to the base beyond the adjustment range, the method comprising having the electric motor drive the frame relative to the base from the first position towards the second position and estimating a positional parameter indicative of a traveled distance of the frame relative to the base with
10 respect to the first position based on a model that includes a parameter indicative of an electrical motor impedance of the electric motor,
wherein, prior to having the electric motor drive the frame relative to the base from the first position towards the second position, the method includes:
15 having the electric motor drive the frame against the end stop, measuring a stall current draw of the electric motor therefrom, and
estimating the electrical motor impedance based on the measured stall current draw.
20
2. The method according to claim 1, comprising:
a setting step that includes estimating a distance parameter based on the model indicative of a distance between the first position and the user-preferred second position; and
25 a non-setting step that includes having the electric motor drive the frame relative to the base from the first position towards the second position, based on the model estimating the positional parameter indicative

of the traveled distance of the frame relative to the base with respect to the first position, and terminating the driving of the frame relative to the base in case the positional parameter substantially corresponds to the distance parameter.

5

3. The method according to claim 2, wherein the setting step includes having a user control the electric motor to drive the frame relative to the base to the user-preferred second position, and having the electric motor drive the frame from the user-preferred second position to the first position while estimating the distance parameter from said driving to the first position.

10

4. The method according to claim 3, comprising compensating the estimated distance parameter and/or the estimated positional parameter for a difference between a driving direction of the frame from the second position towards the first position and a driving direction of the frame from the first position towards the second position.

15

5. The method according to claim 4, wherein the difference is determined by having the electromotor drive the frame relative to the base by a known reference distance in two opposing driving directions.

20

6 The method according to any of the preceding claims, wherein the distance parameter and/or the positional parameter is estimated based on a measured current draw of the electric motor.

25

7. The method according to claim 6, wherein the distance parameter is estimated by integrating an instantaneous motor speed of the electric motor over time, the instantaneous motor speed being estimated based on an instantaneous motor torque of the electric motor, the instantaneous

30

motor torque being estimated based on the measured instantaneous current draw of the electric motor.

8. The method according to any of the preceding claims, wherein the
5 method does not include measuring a position parameter indicative of a position of the frame relative to the base, nor measuring a speed parameter indicative of a speed of the frame relative to the base, nor measuring a torque parameter indicative of a motor torque of the electric motor.

10 9. The method according to any of the preceding claims, comprising estimating a back-EMF constant of the electric motor based on the estimated electrical motor impedance.

10. The method according to claim 9, wherein the estimating of the
15 back-EMF constant includes having the electric motor drive the frame relative to the base by a known reference distance, estimating a positional parameter indicative of a traveled distance of the frame relative to the base, and estimating or adapting the back-EMF constant based on a dissimilarity between the known reference distance and the travelled distance.

20

11. The method according to any of the preceding claims, wherein the frame is adjustable within an adjustment range that extends between two opposing adjustment end positions, and wherein the first position corresponds to an adjustment end position of the adjustment range, and the
25 second position corresponds to a position within the adjustment range between the opposing adjustment end positions.

12. The method according to any of the preceding claims, wherein the frame is part of an external vision unit for a vehicle, and the method
30 comprises adjusting the frame relative to the base about a vertical axis

wherein the first position corresponds to a park position in which the frame extends substantially parallel to the vehicle and the second position corresponds to a drive position in which the frame extends substantially outward from the vehicle.

5

13. The method according to claim 12, wherein the adjustment range includes a first adjustment end position associated with a park position, and a second adjustment end position, opposite the first adjustment end position, in which the frame, with respect to the second position, substantially over-extends outward from the vehicle.

10

14. The method according to claim 13, wherein the first position corresponds to the first adjustment end position.

15. The method according to claim 13, wherein the first position corresponds to the second adjustment end position.

15

16. The method according to any preceding claim, wherein the frame is part of an external vision unit for a vehicle, and the method comprises adjusting the frame relative to the base about a horizontal axis.

20

17. The method of claim 16, wherein the first position corresponds to a park position in which the frame is in a first horizontal pivot position and the second position corresponds to a drive position in which the frame is in a second, different, horizontal pivot position.

25

18. The method according to any of the preceding claims, wherein a predefined detectable reference position is provided in a motion range of the frame between the first position and the second position, wherein the predefined detectable reference position is particularly formed by a

30

resistance increasing or decreasing feature, such as a protuberance and/or indentation for being encountered by the frame when driven between the first position and the second position.

- 5 19. The method according to claim 18, comprising detecting that the frame is driven past the predefined reference position and adjusting the estimated positional parameter based on the detection of the predefined reference position.
- 10 20. The method according to any of the preceding claims, wherein the controller comprises or is operatively connected to a memory that stores a plurality of user-specific second positions, wherein the controller is configured for driving the frame relative to the base to a respective one of the plurality of user-specific second positions in dependence of an identifier
- 15 signal indicative of a user of the vehicle.
21. The method according to any of the preceding claims, wherein the controller comprises or is operatively connected to a memory that stores a plurality of vehicle-specific indications of effort and/or a reference indication
- 20 of effort for a reference vehicle and a converter for converting the reference indication of effort to a vehicle-specific indication of effort, wherein the controller is configured for driving the frame relative to the base to the, e.g. user-specific, second position based on the vehicle-specific indication of effort in dependence of a vehicle identifier signal indicative of the type of
- 25 vehicle.
22. The method according to claim 20 or 21, wherein the memory is remote from the vehicle.

23. An adjustment device, particularly for an exterior vision unit for a vehicle, comprising

a base,

5 a frame connected to the base, and movably drivable relative to the base from a first position to a second position,

an electric motor arranged for driving the frame relative to the base, and

a controller configured for executing a method according to any of the preceding claims.

10

24. An exterior vision unit for a vehicle, comprising an exterior vision element and an adjustment device according to claim 23 for adjusting the exterior vision element.

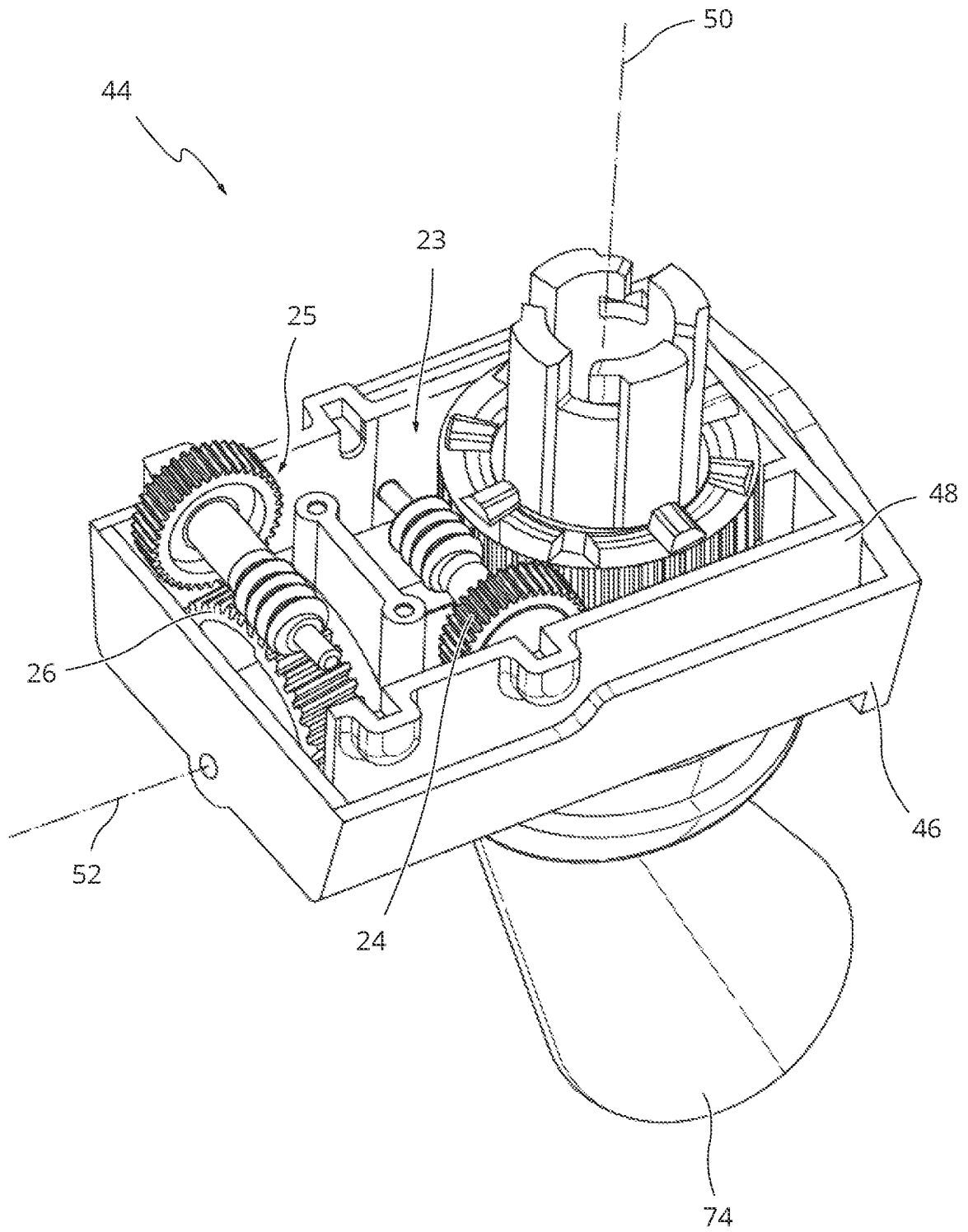


Fig. 1

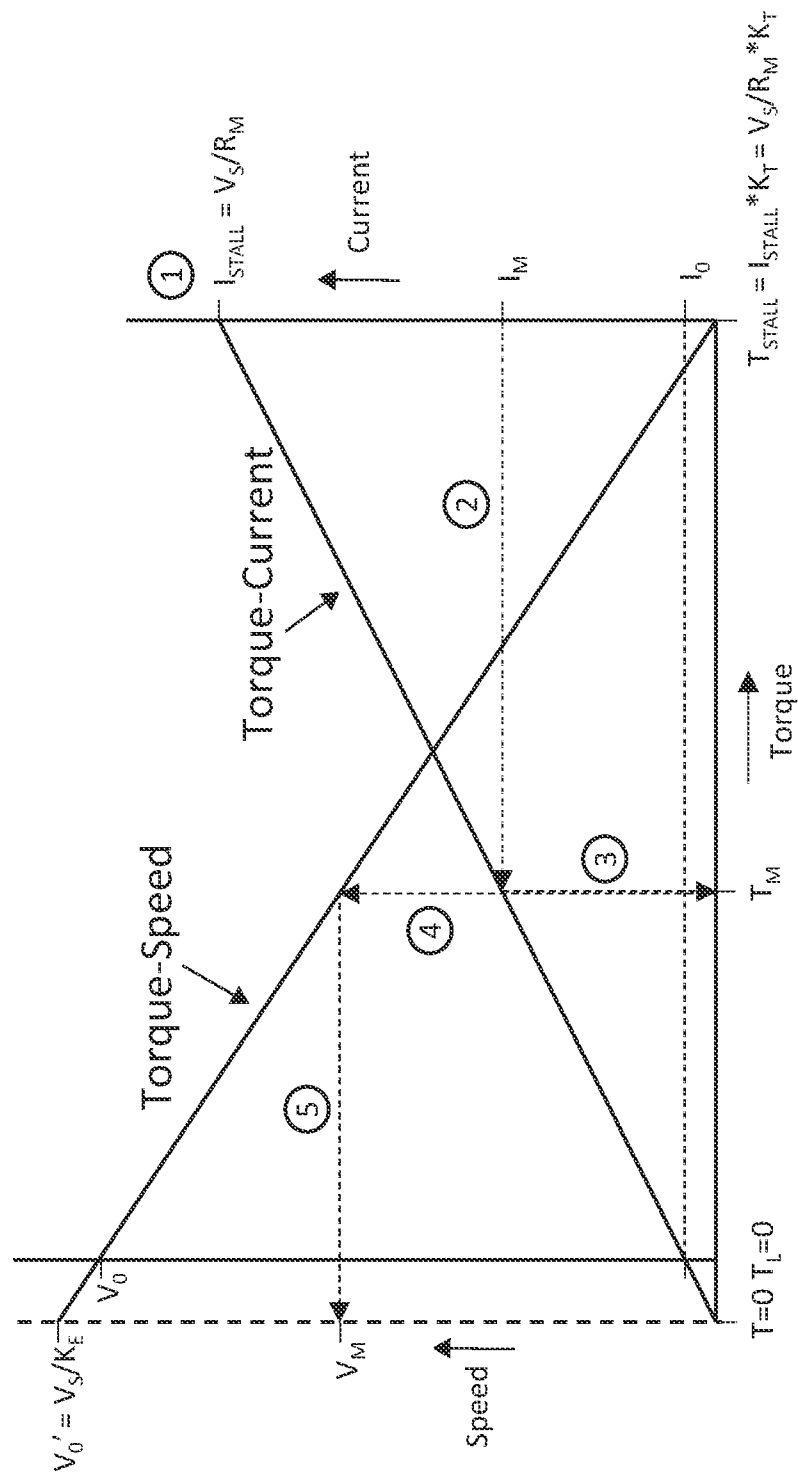


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2024/050307

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60R1/074 H02P7/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B60R H02P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	CN 114 750 693 A (CHINA FAW GROUP CORP) 15 July 2022 (2022-07-15) claims 1-4 -----	1 - 24
A	EP 2 006 998 A2 (TOKAI RIKI CO LTD [JP]) 24 December 2008 (2008-12-24) paragraphs [0015] - [0016], [0029] - [0037]; claims 1,4; figures 1-4 -----	1 - 24
A	US 2020/300881 A1 (HU JINKU [NL]) 24 September 2020 (2020-09-24) claims 1,2; figures 1-3 -----	1 - 24



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

22 July 2024

Date of mailing of the international search report

20/08/2024

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/NL2024/050307

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