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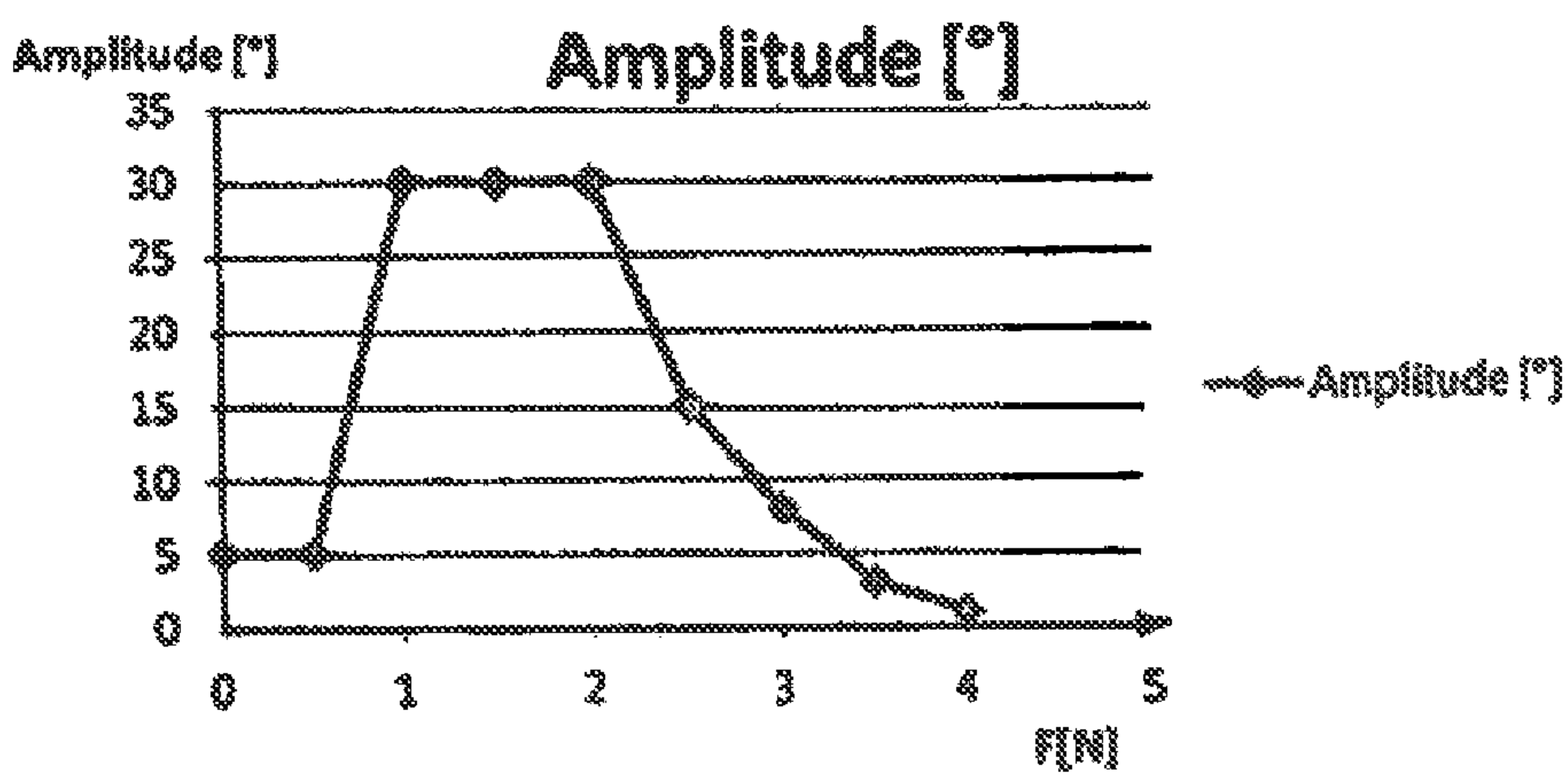

Fig. 3

(57) Abrégé/Abstract:
A personal care device has an electrically powered driving unit for driving a working implement of the personal care device at a desired speed and/or amplitude and/or frequency, and a control unit for controlling the driving unit in response to load onto the working implement to change speed and/or amplitude and/or frequency of the working implement upon a change in load applied thereto. The control unit includes a detector for detecting changes of an operating parameter of the driving unit, which operating value is responsive to load onto the working implement, and a powering unit for varying the electrical powering of the driving unit in response to a detected value of the operating parameter such that speed and/or amplitude and/or frequency of the working implement is changed from an idling value to an increased operation value.

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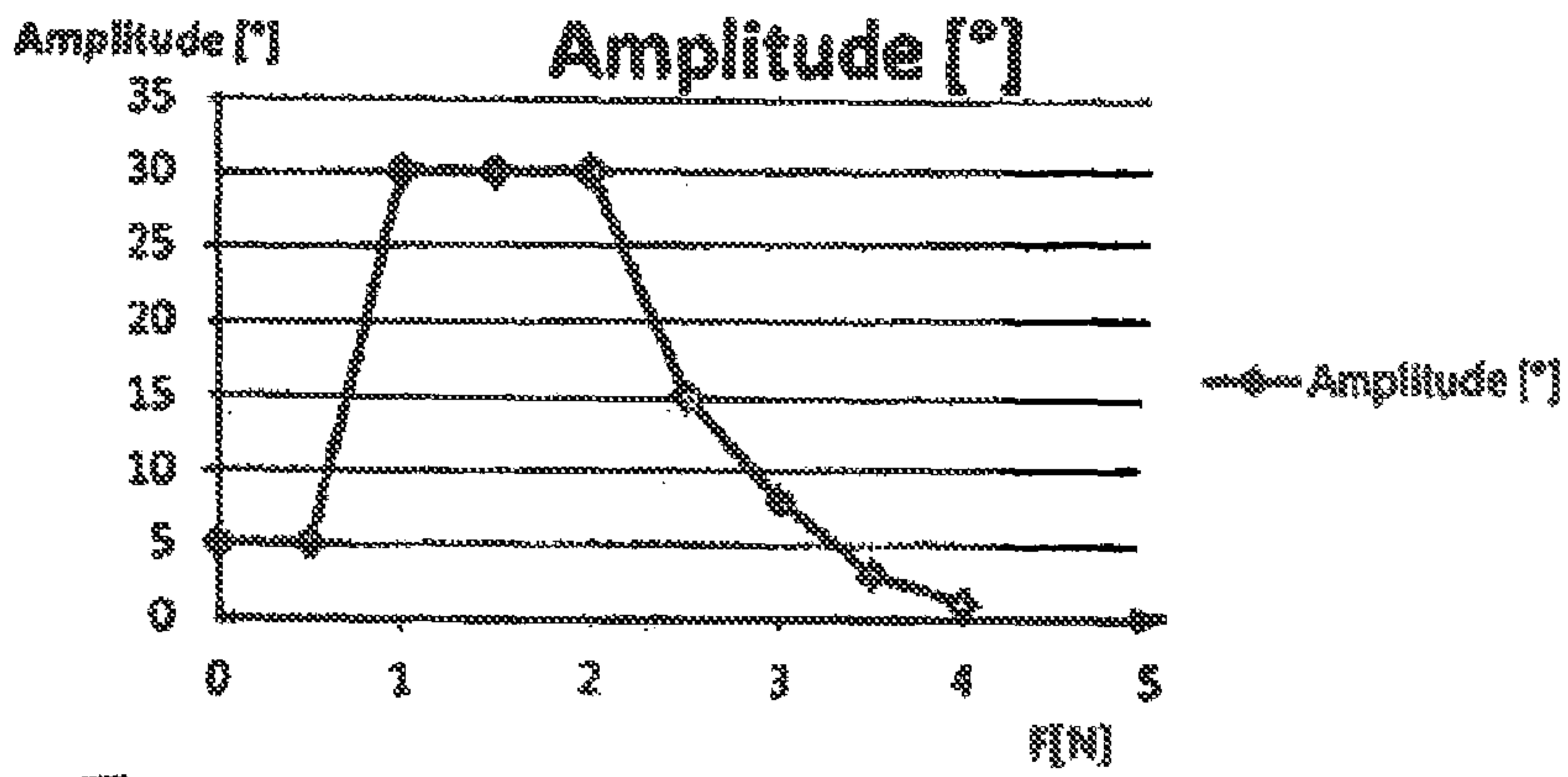

Fig. 3

(57) **Abstract**: A personal care device has an electrically powered driving unit for driving a working implement of the personal care device at a desired speed and/or amplitude and/or frequency, and a control unit for controlling the driving unit in response to load onto the working implement to change speed and/or amplitude and/or frequency of the working implement upon a change in load applied thereto. The control unit includes a detector for detecting changes of an operating parameter of the driving unit, which operating value is responsive to load onto the working implement, and a powering unit for varying the electrical powering of the driving unit in response to a detected value of the operating parameter such that speed and/or amplitude and/or frequency of the working implement is changed from an idling value to an increased operation value.

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PERSONAL CARE DEVICE

FIELD OF THE INVENTION

The present invention relates to a personal care device such as an electric toothbrush or shaver.

BACKGROUND OF THE INVENTION

Power-driven personal care devices such as electric toothbrushes or shavers are known. For example, the working implement of an electric toothbrush may include a bristle field arranged on a head that is driven by an electric motor in an oscillating rotation wherein the head may be connected to a motor shaft through a transmission train including gearing structure to transform motor shaft rotation into the desired bristle field movement. In another example, the head of a toothbrush is driven in a vibrating manner wherein the vibrating movement may be achieved by means of a rotating eccentric mass causing vibration of the brush head and the bristle field provided thereon. In still other examples, the heads of electric toothbrushes may be driven by magnetic drive systems effecting oscillating movement of the head by means of applying cyclically varying magnetic fields to a magnetic drive element.

A feature commonly found on electric toothbrushes and other personal care devices is an on/off switch or button which may be actuated to electrically activate or deactivate the driving unit of the device. The primary feature of such a switch is that it remains either in the “on” position or the “off” position until the user manually changes it. When the driving unit is activated prior to the head being placed in the mouth, the bristle field is run at a predetermined speed, amplitude and/or frequency intended for normal brushing mode operation which may cause fluid and toothpaste to splatter around and unwanted noise to be generated.

In view of such shortcomings, it is known to provide an electric toothbrush with an automatic mode of operation in which the driving unit is activated when the toothbrush is being used in the mouth, i.e. when the bristle field is pressed against teeth. It is also known to automatically start the driving unit of a toothbrush when contact with saliva, optionally mixed with toothpaste and water, is detected at the head which is provided with electrical conducting elements that respond to electrical conductivity of fluids present in the mouth. Furthermore, it is known to detect deflection of the toothbrush neck when pressing the head against the teeth and to activate the driving unit when such deflection exceeds beyond a certain threshold.

Such known automatic mode controls are rather complicated in structure, bulky in size and expensive in realization. The detection sensors for detecting pressure onto the bristle field or the presence of saliva need additional wiring and are detrimental to compact, small-sized designs.

Accordingly, it is desirable to provide an improved personal care device that allows for variation of the working implement speed, amplitude and/or frequency in response to load onto the working implement in a relatively simple manner.

SUMMARY OF THE INVENTION

In some embodiments, load onto a working implement of a personal care device is determined through detecting an operating parameter of a driving unit responsive to load onto the working implement. The variation of the speed and/or amplitude and/or frequency value may be triggered either by the absolute value of the operating parameter or by a detected change of the operating parameter.

In some embodiments, speed and/or amplitude and/or frequency of the working implement are changed from an idling value to an operation value, optionally an operation value that is increased over the idling value, in response to a change of an operating parameter of the driving unit responsive to load onto the working implement.

In some embodiments, a personal care device is provided with a control unit including a detector for detecting changes of an operating parameter of the driving unit responsive to load onto the working implement. The personal care device may further comprise a powering unit for varying the electrical powering of the driving unit and/or operating the driving unit in different modes in response to a detected change of the operating parameter of the driving unit. In such embodiments, the speed and/or amplitude and/or frequency of the working implement is changed from a idling value to an operation value, wherein the speed and/or amplitude and/or frequency may in particular be increased. In response to an increase in load onto the working implement, the driving unit may be switched from an idle mode to an operation mode or mode of regular operation.

According to an embodiment, the operating parameter of the driving unit that is monitored to determine load onto the working implement includes speed and/or amplitude and/or frequency of the driving unit. The detector of the control unit may include a speed determining unit for determining a change in speed, and/or determining speed under no load and determining speed under load, and/or amplitude and/or frequency of the driving unit and/or a change (e.g. a decrease) for any of these parameters.

The powering unit may be arranged to adapt the electric powering such that speed and/or amplitude and/or frequency of the working implement is changed (e.g. increased) from an idling value to an operation value upon determination of a decrease in speed and/or amplitude and/or frequency of the driving unit when supplying electric power to the driving unit in an idling mode. The speed determining unit can have different embodiments, wherein a speed sensor may be provided for sensing rotational speed of a motor shaft or a transmission shaft or another element, linear velocity of a shaft or other moving part of a motor, of a drive train. Additionally or alternatively, the speed determining unit may include electronic circuitry associated with the driving unit and/or a power supply unit supplying electric power to the driving unit to determine speed and/or amplitude and/or frequency of the driving unit in an electronic manner on the basis of current signals present in or supplied to the driving unit.

In an embodiment, where speed and/or amplitude and/or frequency of the driving unit is detected as operating parameter to determine load on the working implement, it may be assumed that speed and/or amplitude and/or frequency of the driving unit will at least temporarily show a change, e.g. a decrease, when a load is applied at the working implement, e.g. by means of pressing the bristle field against teeth.

Alternatively or additionally, a characteristic electric parameter may be detected as operation parameter of the driving unit to determine load onto the working implement and variations thereof. For example, the detector of the control unit may include a determining unit for determining a variation of an electric operation parameter of the driving unit responsive to load onto the working implement. The powering unit may be adapted such that electric powering is varied to increase speed and/or amplitude and/or frequency of the working implement to the desired operation value upon determination of a variation of the electric operation parameter indicative of a certain load onto the working implement.

Different electric operation parameters may be detected to determine load onto the working implement. In an embodiment, current consumption of the driving unit may be monitored as operating parameter and may be used for triggering a change (i.e. an increase or a decrease) of the speed and/or amplitude and/or frequency of the working implement to the desired value thereof. The detector may include a current detector for detecting current consumption of the driving unit. The control unit may be adapted such that electric powering of the driving unit is varied to change speed and/or amplitude and/or frequency of the working implement to the desired operation value upon determination of a specific current consumption and/or increase thereof. Using the current consumption of the driving unit for determining load onto the working implement allows for simple structure of the detector. Basically, a current meter or voltage meter may suffice.

Current consumption of the driving unit may be analyzed in different ways. Current consumption may be compared to a predetermined absolute value and, when current consumption exceeds such predetermined absolute value, speed and/or amplitude and/or frequency of the working implement may be increased to the desired operation value. Alternatively or additionally, current consumption may be monitored and variations of the current consumption of the driving unit may be compared to at least one specific variation characteristic which may include slope and/or the amount of variation. For example, if the variation of the current consumption exceeds a certain slope, i.e. the amount of variation per time, and/or a specific amount of increase, the control unit may vary electric powering of the driving unit to increase the speed and/or amplitude and/or frequency of the working implement to the desired operation value.

Additionally or alternatively, the detector of the control unit may include an electronic detection unit for detecting deviations in amplitude, pulse width and/or progression of current and/or voltage present in the driving unit or an element thereof or a component connected thereto, from the current and/or voltage signal of the electric power supplied to the driving unit. For example, it may be detected if the current signal in a coil of a motor of the driving unit follows a predetermined signal in terms of signal shape, amplitude, pulse width and/or offset in time in a sufficient close manner. When deviations exceed a predetermined threshold, the control unit may assume there is sufficient load onto the working implement going beyond the unloaded state so that the operation state may be switched from idling mode to operation mode.

The control unit may include an idle powering unit for controlling the driving unit in an idle mode providing for an idling value of speed and/or amplitude and/or frequency of the working implement which idling value may be reduced in comparison to the desired operational value.

Upon detection of load onto the working implement, the idle powering unit may be deactivated so that the driving unit does not return to idle mode when load onto the working implement falls below a certain value or the working implement is completely unloaded. Alternatively, the idle control may be activated again when the control unit detects the load onto the working implement falling under a certain lower limit. In some embodiments, the idle powering unit may be activated when the load on the working implement exceeds a certain value.

The idle powering unit may be operatively connected to an on/off switch to activate the idle powering unit upon switching on the driving unit.

BRIEF DESCRIPTION OF THE DRAWINGS

The above object and other objects, features and advantages of the present invention are readily apparent from the following detailed description of an embodiment of the invention when taken in connection with the accompanying drawings.

In the drawings show:

Fig. 1: A simplified, partly cross-sectional view of a personal care device realized as an electric toothbrush according to an example embodiment,

Fig. 2: a flow chart showing the control steps performed by the control unit of the personal care device of Fig. 1, and

Fig. 3: a functional diagram showing the amplitude of the working implement over load applied to the working implement.

DETAILED DESCRIPTION OF THE INVENTION

Generally, a personal care device as proposed includes a control unit that controls a driving unit of the personal care device, which driving unit drives a working implement of the personal care device at a certain speed and/or amplitude and/or frequency. The control unit may comprise a detector for detecting an operation parameter of the personal care device that is indicative of the load that is applied at the working implement. In some embodiments, the detector may detect an operation parameter of the personal care device that identifies whether the personal care device is in a loaded state or an unloaded state.

In one embodiment, the control unit may be arranged to change the powering of the driving unit in dependence on the detected absolute value of the operating parameter, i.e. to change the powering of the driving unit when the operating parameter is above or below a first (second, third,…) threshold value. In another embodiment, the control unit may be arranged to change the powering of the driving unit in dependence of a change of the operating parameter, e.g. a characteristic decrease of the operating parameter indicative of an applied load. The control unit may be arranged to power the driving unit such that speed and/or amplitude and/or frequency of the working implement is at an idling value if the load applied at the working implement is below a first threshold load value (and thus above or below a first threshold value of the operating parameter). The control unit may be arranged to vary the powering of the driving unit to achieve a certain operation value of the speed and/or amplitude and/or frequency of the working implement when the operating parameter indicates a load at or above the first threshold load value. The control unit may in one embodiment be arranged to vary the powering again when the load applied at the working implement is at or above a second threshold load value or in some embodiments the speed and/or amplitude and/or frequency may be set to zero or essentially zero when a load at or above the second threshold load value is detected. In some embodiments, the control unit is arranged to power the driving unit such that an idling value of the speed and/or amplitude and/or frequency is achieved when the personal care device is switched on.

Fig. 1 shows an example embodiment of a personal care device 1 in accordance with the present disclosure, where the personal care device 1 may be realized as an electric toothbrush. As shown by Fig. 1, the personal care device 1 may include a handle 2 formed by an elongated hollow casing within which other portions of the personal care device may be disposed such as a battery, a driving unit 6 including a motor 7 and a control unit 9 for controlling the motor 7. Furthermore, the personal care device 1 includes a functional element 4, here realized as a brush head, which is connected to the handle 2 by means of a neck 3. The neck 3 may be detachably connected to a driving element 16 that may be driven by motor 7 so that the functional element 4 forms an exchangeable attachment of the personal care device 1.

As shown by Fig. 1, the functional element 4 here comprises a bristle field 5 which includes a plurality of bristles that may be arranged in any known manner. However, the functional element 4 may include alternatively or additionally cleaning elements such as needle-like interdental cleaning elements, sponge-like massaging elements, elastomeric elements, polishing elements or other oral treatment elements. In the shown example embodiment, the functional element 4 forms a working implement 12 in accordance with the present disclosure as the whole functional element 4 is driven into an oscillatory motion having an amplitude, a frequency and a speed. In another example embodiment, the functional element 4 may comprise a carrier element movably mounted at the functional element 4, which carrier element may carry a bristle field and which carrier may be driven into an oscillatory motion. In such an embodiment, the carrier element carrying the bristle field forms a working implement in accordance with the present disclosure.

The functional element 4 can be driven to move in an oscillating manner as indicated by arrow 17. The aforementioned driving element 16 may be supported pivotably within handle 2 to swing to and fro. Consequently, the neck 3 connected to the driving element 16 rotates in an oscillating manner about an axis extending substantially perpendicular to the longitudinal extension of the neck 3.

The motor 7 may include coils 18 for generating a magnetic field that interacts with magnets 19 provided on the driving element 16. To provide the motor 7 with electric power, the personal care device 1 may include a power supply 20 which may include batteries received within handle 2 and/or a mains adapter to be connected to an external power supply.

A control unit 9 controls the motor 7 and supplies driving signals to the coils 18 to generate a cyclically varying magnetic field to drive the driving element 16. In some embodiments, the motor is a DC motor, in other embodiments, a resonant motor may be utilized.

Control unit 9 further includes a detector 10 to detect operating parameters of the driving unit 6. The control unit 9 may further comprise a powering unit 11 for varying power to the drive unit 6 based upon the measured operating parameter(s) of the drive unit 6.

The detector 10 may include speed detector 13 for detecting speed, amplitude and/or frequency of the movement of the driving element 16. Furthermore, the detector 10 may include a determining unit 14 for determining at least one electric operation parameter of the motor 7, which determining unit 14 may include a current detector 14a for detecting current consumption of the driving unit 6. The detector 10 may further comprise an electronic detection unit for detecting deviations of the current and/or voltage signal present in the driving unit 6 from a current and/or voltage signal of the electric power supply to the driving unit 6 in terms of amplitude, pulse width and/or frequency and/or signal shape. Embodiments can be varied where the detector 10 comprises at least one of the speed detector 13, the determining unit 14, the current detector 14a, the electronic detection unit, or any suitable combinations thereof.

Referring now to Figures 1 and 2, a personal care device 1 may be provided with different operation modes including an idle mode and a regular operation mode. When the personal care device 1 is started by means of pushing or pressing an on/off switch 15, the motor 7 is energized to drive the functional element 4. Upon starting the driving unit 6, the control unit 9 may start in an idle mode wherein the motor 7 is run with a reduced preset energy input such that the driving element 16 and thus the functional element 4 executes a movement having at least one of a reduced amplitude and/or reduced frequency so that at least one of these idle parameters is smaller than an amplitude or an frequency used during regular teeth-cleaning operation. In some embodiments, when the personal care device 1 is initially powered on, the personal care device 1 may operate in the regular operation mode and subsequently, assuming no load, change to the idle mode.

As shown by Fig. 3, the idle mode may be utilized at applied loads below 1 Newton. In the idle mode the amplitude (here: angular deflection) of greater than 0°, but, e.g., less than 15° may be provided to the functional element 4. As shown, the amplitude in the idle mode may be 5 degrees. Typically, a low amplitude or a low speed is desirable for the idle mode insofar as a small amplitude (or a low speed) provides for a user-perceivable signal that the personal care device is switched on (i.e. that the personal care device is operational). Further, a substance such as water or toothpaste that may be applied to the working implement is less likely to be splattered around at a low amplitude/low speed, and also the noise generated by the personal care device tends to be lower than the noise generated in a standard operation mode. Generally, in the idle mode, the amplitude in terms of an angular displacement may be chosen to lie in a range of between about 0.5 degrees to about 10 degrees, or in other terms, the low amplitude may be chosen to lie within a range of between about 5% to about 75% of the desired operation amplitude. In an embodiment in which the working implement is driven into a linear oscillation, the low amplitude in idle mode may be chosen to lie in a range of between about 0.05 mm to about 0.5 mm or again may be chosen to lie within a range of between about 5% to about 75% of the desired operation amplitude. Operational amplitude may be chosen to lie in a range of between about 2 degrees to about 90 degrees or between about 0.2 mm to about 5 mm. The operation amplitude may depend on the personal care device. In some embodiments, a shaver may benefit from larger amplitudes such as operation amplitudes of 2 mm or higher (or 30 degrees or higher angular deflection), while a toothbrush may be restricted to smaller operation amplitudes to avoid user discomfort, thus operation amplitudes of below 2 mm (or below 30 degrees angular deflection).

Additionally or alternatively, to the change of the amplitude from an idle amplitude value to an operation amplitude value, the frequency and/or the speed at which the working implement moves may be changed. In the idle mode, the frequency (for an oscillatory motion this parameters is inherently coupled with the speed parameter) may be chosen to lie in a range of between about 1 Hz to about 50 Hz, while the operational frequency may be chosen to lie in a range of between about 20 Hz to about 1,000 Hz. As an example, for an electric toothbrush the idle mode frequency value may be chosen to lie in a range of between about 1 Hz and 30 Hz and the operational frequency value may be chosen to lie in a range of between about 50 Hz to about 300 Hz.

During such initial idle mode, the electronic control unit 9 detects at least one of the aforementioned operation parameters of the driving unit 6, which operating parameters may include speed, amplitude, frequency, current consumption or characteristics of the driving signal and/or the response signal in the coils 18 to determine if load is applied to the bristle field 5. If a load at or above a certain first threshold load value is applied to bristle field 5, at least one of speed, amplitude or frequency will change (usually increase) in comparison to the respective idling value under a no load condition. For sake of completeness it is again stated that the control unit 9 detects at least one operation parameter of the driving unit 6 that is indicative of the load applied at the working implement. As such, the operating parameter may have a value above or below a certain first threshold value to indicate that the load applied at the working implement is above a first threshold load value. If the measured operating parameter(s) are indicative of a load, i.e. the measured value exceeds the first threshold value, then the control unit 9 may switch the driving unit 6 to be operated in a second operation mode which may be a regular operation mode, e.g. a regular teeth-cleaning mode in case that the personal care device is realized as an electric toothbrush. As shown by Fig. 2, the energy transfer from the electronics to the motor 7 is then increased so that the amplitude and/or speed and/or frequency of the driving element 16 and therefore of the working implement 12 is increased to an operation value. For example, the amplitude may be increased by at least 10° in comparison to the idle mode, wherein Fig. 3 shows an increase to an operation amplitude of about 30°. However, other amounts of increase are possible as has been discussed.

According to an embodiment, the amplitude of the working implement 12 is increased from an idle amplitude value to an operation amplitude value, whereas the frequency may be kept constant to avoid irritation of the users due to the changes in the device sound.

After having switched the driving unit 6 to the operation mode, idle mode control may be resumed upon detection of an unloaded condition. However, alternatively such idle mode control may not be resumed after having switched the driving unit 6 to the regular operation mode even if the load onto the bristle field 5 drops to zero. Embodiments can be further varied , where idle mode is automatically resumed after the conclusion of a predetermined time period. For example, after the expiration of two minutes, the idle mode may be resumed. In some embodiments, after the conclusion of three minutes, the idle mode may be resumed. The reactivation of the idle mode can provide a signal to the user that they have brushed for a requisite time period.

The switching between idle mode and normal run mode can occur at any suitable applied force to the contact elements 5. For example, at an applied force of zero Newtons, the idle mode may be utilized. However, at an applied force to the contact elements 5 of greater than zero Newtons, the regular operation mode may be utilized. In some embodiments, an applied force of greater than about 0.2 N, greater than about 0.3 N, greater than about 0.4 N, or greater than about 0.5 N, greater than about 0.6 N, greater than about 0.7 N, greater than about 0.8 N, greater than about 0.9 N, greater than about 1.0 N, may be utilized to determine when to change from idle mode to regular operation mode.

As shown by Fig. 3, the control unit 9 may include an overload control mode, wherein the amplitude is again reduced when the detector 10 detects an operation parameter indicative of an excessive load onto the working implement (i.e. when the load is at or above a second threshold load value). Depending on the working implement and the personal care function to be carried out, it also would be possible to reduce frequency and/or speed upon detection of such overload condition. As shown by Fig. 3, the reduction of the amplitude may depend on the amount of overload. The more the load increases, the more the amplitude may be reduced, wherein the amplitude may be reduced to zero, i.e. the driving unit 6 may be stopped completely when load reaches a certain value beyond useful regular load values. In some embodiments, where the measured operating parameter(s) of the drive unit 6 are indicative of a load which is greater than about 3N, the control unit 9 may implement the safe mode.

Control of the amplitude may use a stored reference profile for the amplitude as shown in Fig. 3. According to a more sophisticated embodiment, the control unit 9 may include an input unit (e.g. a touch sensitive screen, one or several sensor switches, one or several knobs etc.) to input such reference profile to allow for modification of the stored reference profile and/or input of a completely new custom-made reference profile.

As the functional elements available for toothbrushes can vary, testing may be required to set initial thresholds for operating parameters particularly in the case where the measured operating parameters are electrical characteristics. For example, in an unloaded state, in idle mode, an idle mode current supplied to a drive unit of a toothbrush may be measured. The idle mode current may be utilized as a first threshold current. Also, in embodiments where operating parameter(s) are utilized for conditions where too high of an applied load is used, a high load current may be measured. For the high load current, an applied load of about 3 N, or the desired cutoff for high load may be applied to the contact element field. In the normal run mode and with the applied load of about 3 N, the high load current can be measured and can be utilized as the second threshold current. This type of testing may be repeated for as many different types of functional elements as needed.

So, in operation, the control unit may be programmed such that measured currents below the first threshold current is indicative of a no load condition. Measured currents above the first threshold but less than the second threshold may be indicative of a normal applied load, i.e. regular brushing. And, measured currents above the second threshold may be indicative of too high of an applied load being utilized.

For those embodiments where the operating parameter measured is speed of the functional element, similar testing may be utilized. For example, in the idle mode, an idle mode speed may be measured and set as the first threshold. In operation, the control unit may be programmed such that any measured decrease in the idle mode speed or a measured speed which is less than the idle mode speed is indicative of an applied load, i.e. regular brushing.

For those embodiments where the operating parameters are utilized for determining too high of an applied load, a high load speed may be measured. In the normal operation mode, an applied load of 3 N may be applied to the contact element field, and the high load speed may be measured. The high load speed may be set as the second threshold. The control unit may be programmed such that measured speeds below the second threshold are indicative of too high of an applied load being utilized.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

AMENDED CLAIMS
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1. A personal care device comprising:

an electrically powered driving unit (6) for driving a working implement (12) of the personal care device at a desired speed and/or amplitude and/or frequency, and

a control unit (9) for controlling the driving unit in response to load onto the working implement (12) to change speed and/or amplitude and/or frequency of the working implement (12) upon an increase in load applied thereto,

wherein the control unit (9) includes a detector (10) for detecting an operating parameter of the driving unit (6) responsive to load onto the working implement (12), and a powering unit (11) for varying the electrical powering of the driving unit (6) in response to a detected value of the operating parameter, optionally in response to a detected change of the operating parameter, such that speed and/or amplitude and/or frequency of the working implement (12) is changed from an idling value to an operation value,

wherein the idling value is at least about 5% of the operation value, optionally wherein the idling value lies between about 5% and about 75% of the operation value, and further optionally wherein the idling value lies between about 5% and about 30% of the operation value.

2. The personal care device of claim 1, wherein the detector (10) includes a speed determining unit (13) for determining a change in speed and/or amplitude and/or frequency of the driving unit (6), wherein the powering unit (11) is adapted such that the electric powering is varied to increase speed and/or amplitude and/or frequency of the working implement (12) to the desired operation value upon determination of a specific decrease in speed and/or amplitude and/or frequency of the driving unit (6).

3. The personal care device of anyone of the preceding claims, wherein the control unit is arranged to vary the electric powering of the driving unit when the operation parameter indicates a load above a first threshold value.

4. The personal care device of anyone of the preceding claims, wherein the detector (10) includes determining unit (14) for determining a variation of an electric operation

parameter of the driving unit (6), wherein the powering unit (11) is adapted such that electric powering of the driving unit (6) is varied to increase speed and/or amplitude and/or frequency of the working implement (12) to the desired operation value upon determination of a specified variation of the electric operation parameter.

5. The personal care device of the preceding claim, wherein the determining unit (14) includes a current detector (14a) for detecting current consumption of the driving unit (6), wherein the powering unit (11) is adapted such that electric powering of the driving unit (6) is varied to increase speed and/or amplitude and/or frequency of the working implement (12) to the desired operation value upon determination of a specific current consumption and/or increase thereof.

6. The personal care device of the preceding claim, wherein the determining unit (14) is arranged to compare the current consumption to a predetermined absolute value and/or to compare a variation in current consumption to at least one specific variation characteristic, preferably slope and/or amount of variation, wherein the driving unit (6) is arranged to increase speed and/or amplitude and/or frequency of the working implement (12) when the current consumption exceeds the predetermined absolute value and/or the variation in current consumption exceeds a predetermined slope and/or a predetermined amount of variation.

7. The personal care device of anyone of the preceding claims, wherein the detector (10) includes an electronic detection unit for detecting deviations of current and/or voltage present in the driving unit (6) from a current and/or voltage signal of the electric power supplied to the driving unit (6) in terms of amplitude and/or pulse width and/or frequency and/or signal shape.

8. The personal care device of anyone of the preceding claims, wherein the control unit (9) includes an idle powering unit for controlling the driving unit (6) in an idle mode providing for an idling value of speed and/or amplitude and/or frequency of the working implement, the idle powering unit being operatively connected to an on/off switch (15) for switching on/off of the driving unit (6) to activate the idle powering unit upon switching on the driving unit (6).

9. The personal care device according to the preceding claim, wherein the idle powering unit is deactivated once the detector (10) detects a change of the monitored operating parameter in response to load onto the working implement (12).

10. The personal care device according to anyone of the preceding claims, wherein the control unit (9) provides for at least two different operation modes including an idle mode wherein the driving unit (6) is run with a reduced preset energy input and a regular operation mode wherein the driving unit (6) is run with an energy input larger than the reduced preset energy input of the idle mode, wherein the control unit (9) automatically selects the idle mode upon starting the driving unit (6).

11. The personal care device according to anyone of the preceding claims, wherein the control unit (9) is provided with storing means for storing a reference profile which includes at least one predetermined value selected from the group consisting of speed and amplitude and frequency related to specific load values and/or operating parameter values indicative thereof, wherein the control unit (9) is arranged to use the stored reference profile to determine speed and/or amplitude and/or frequency for different load conditions.

12. The personal care device according to the preceding claim, wherein the control unit (9) is provided with an input unit for entering and/or modifying the stored reference profile.

13. The personal care device according to anyone of the preceding claims, wherein the driving unit comprises a resonant motor.

14. A personal care device comprising:

an electrically powered driving unit (6) for driving a working implement (12) of the personal care device at a desired speed and/or amplitude and/or frequency; and

a control unit (9) for controlling the driving unit such that the working implement is driven with an idling value of speed and/or amplitude and/or frequency when the personal care device is switched on;

wherein the control unit includes a detector (10) for detecting an operating parameter of the driving unit (6), which operation value is responsive to load onto the working implement (12), and a powering unit (11) for varying the electrical powering of the driving unit (6) in response to a detected value of the operating parameter representing a load that is above a certain threshold load such that speed and/or amplitude and/or frequency of the working implement (12) is changed from the idling value to an operation value,

wherein the idling value is at least about 5% of the operation value and optionally wherein the idling value is at least 5% of the operation value but not higher than about 75% of the operation value.

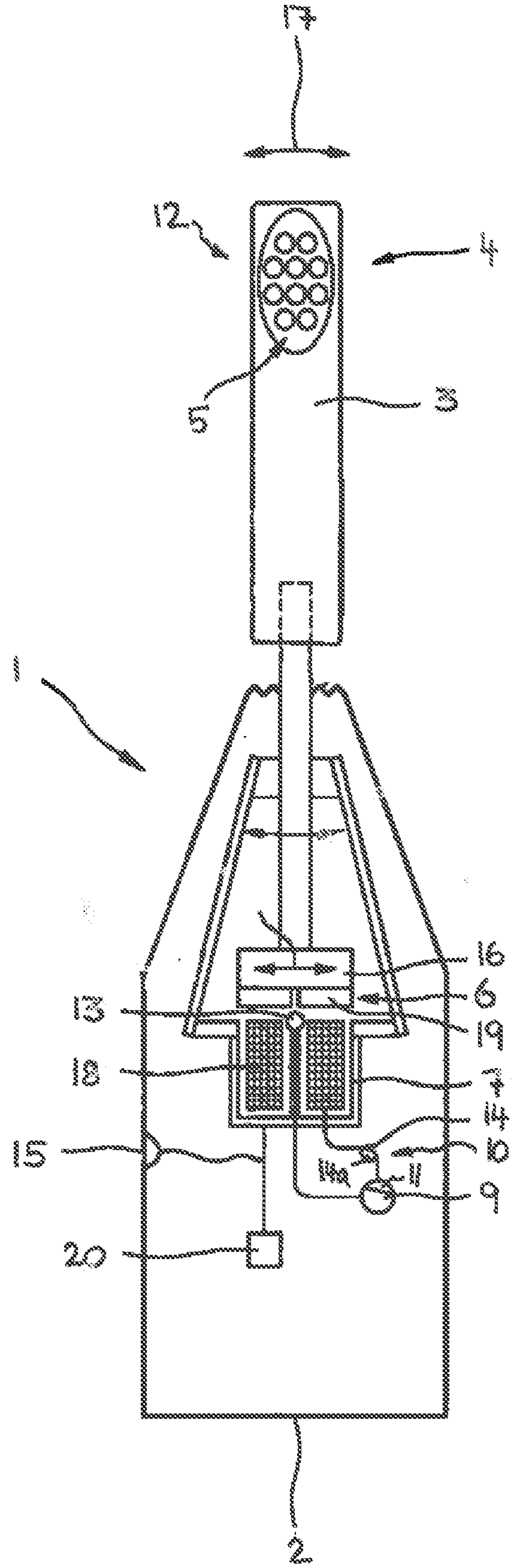

Fig. 1

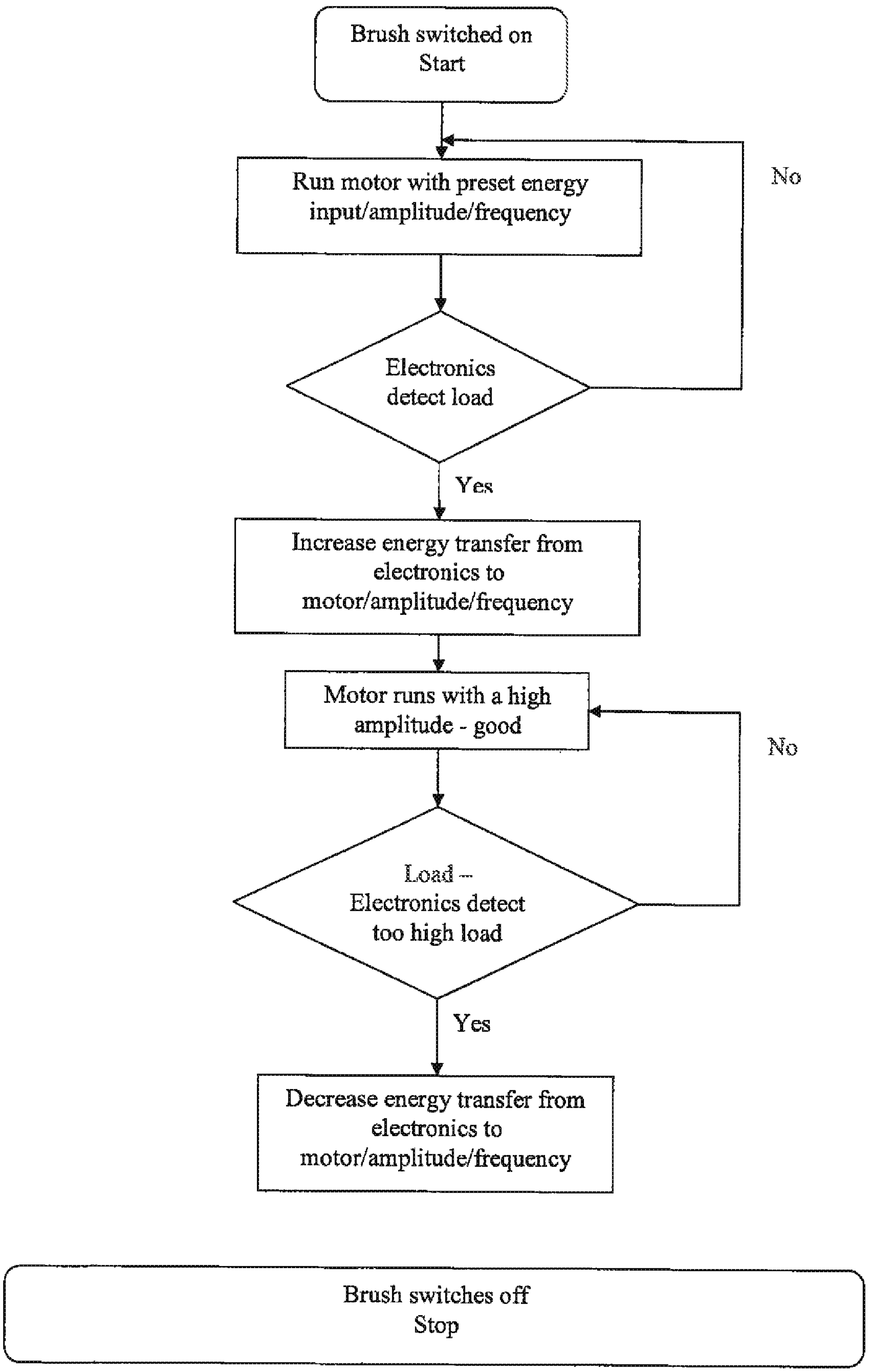
Brush switched on
Start
Run motor with preset energy input/amplitude/frequency
No
Electronics detect load
Yes
Increase energy transfer from electronics to motor/amplitude/frequency
Motor runs with a high amplitude - good
No
Load –
Electronics detect too high load
Yes
Decrease energy transfer from electronics to motor/amplitude/frequency
Brush switches off
Stop

Fig. 2

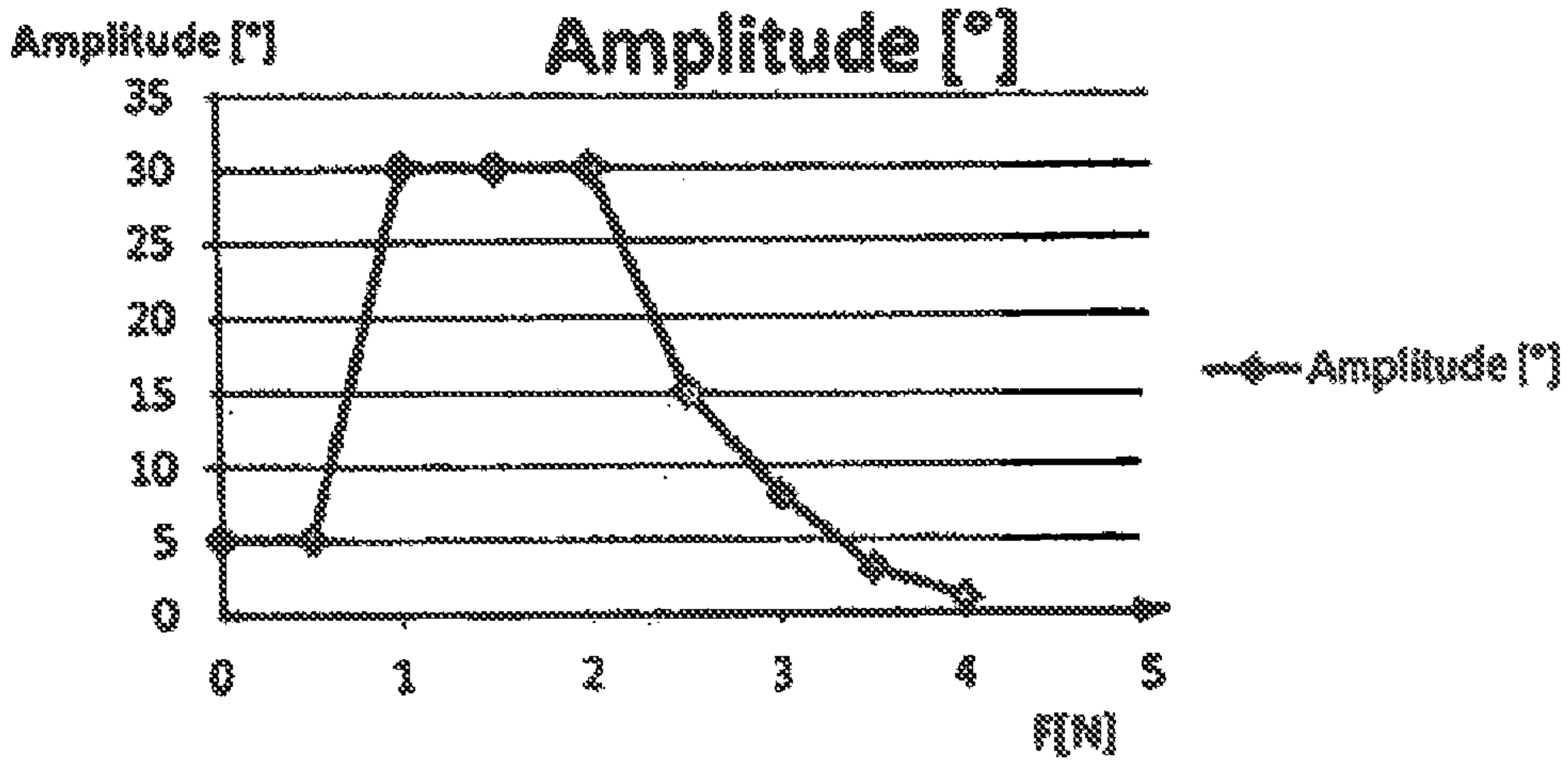

Fig. 3

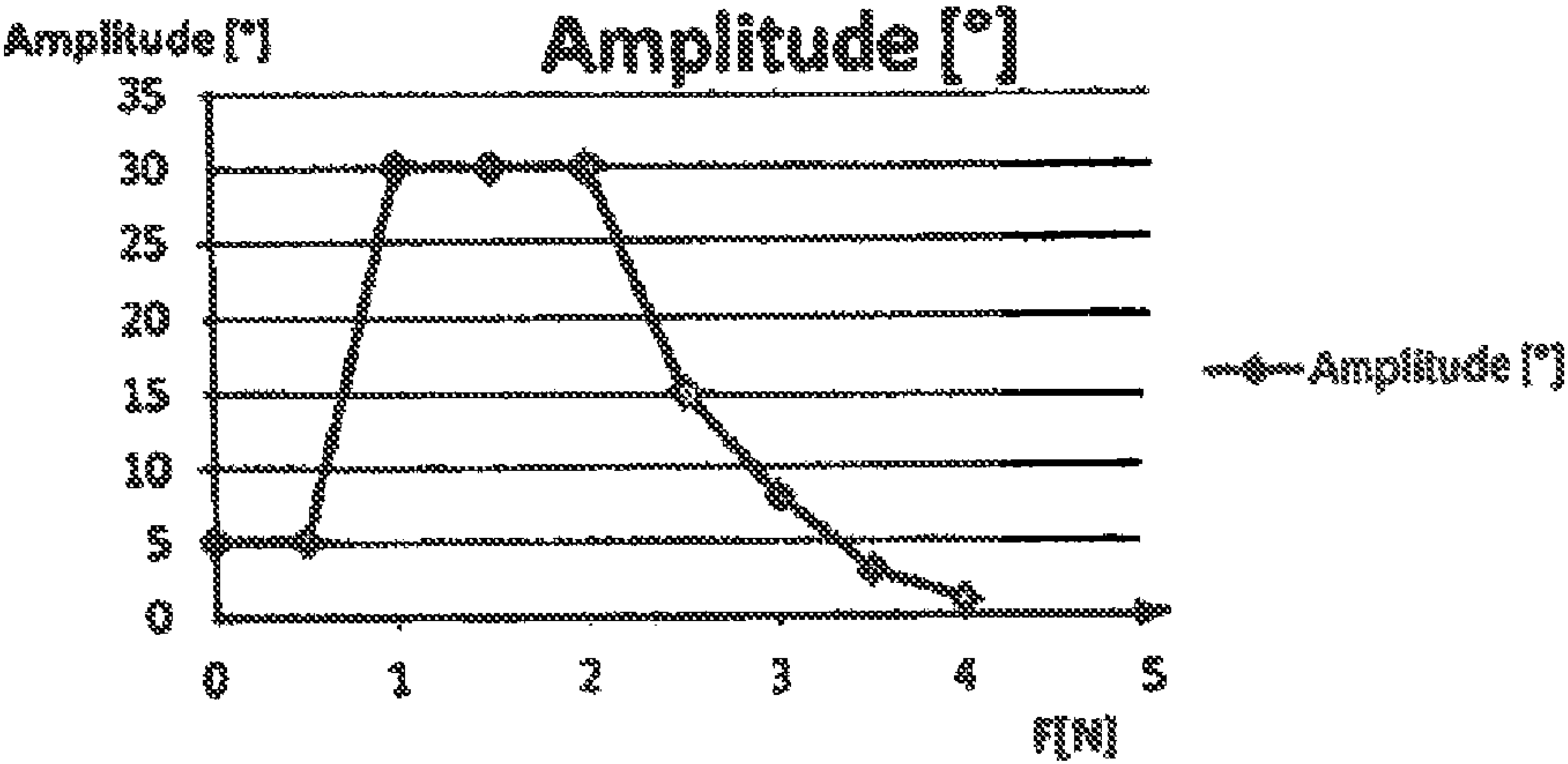

Fig. 3