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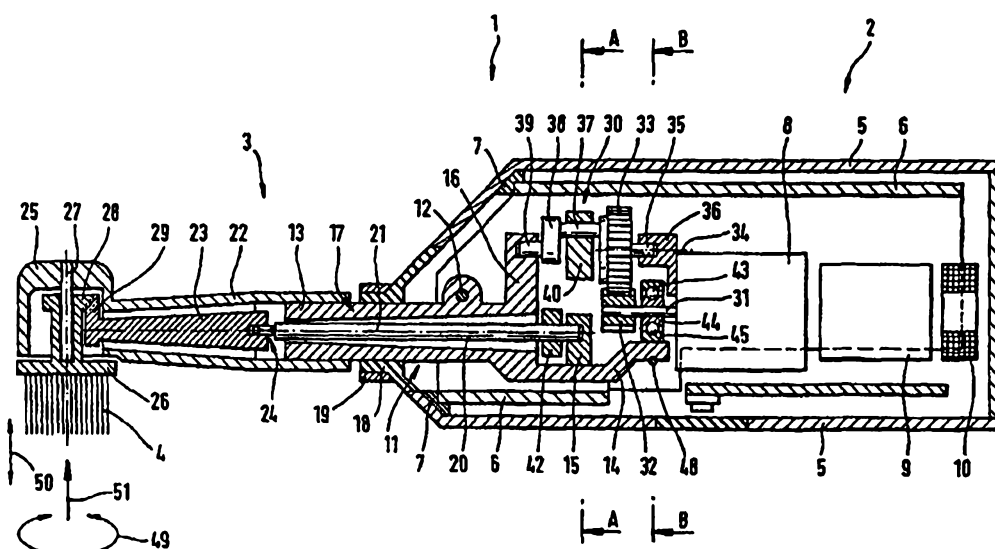
(54) Title: ELECTRIC TOOTHBRUSH

(54) Bezeichnung: ELEKTRISCHE ZAHNBÜRSTE

(57) Abstract

The invention concerns an electric toothbrush (1) comprising a handle part (2) and a brush part (3). The handle part (2) houses an electric motor (8) which is coupled to a shaft (20) that projects from the handle part (2). The brush part (3) can be attached to the handle part (2). Mounted on the brush part (3) is a bristle-carrier (26) which can be coupled to the shaft (20) and from which a plurality of bristles (4) protrude. In the switched-on operating state, the bristle-carrier (26) carries out a rotational movement (49) and a lifting movement (50), the frequency of the lifting movement

(50) being greater, preferably substantially greater, than the frequency of the rotational movement (49). The lifting movement (50) takes the form of a poking movement of the bristles (4) which releases plaque from the tooth surface, the rotational movement (49) wiping the released plaque away from the tooth surface.



(57) Zusammenfassung

Es wird eine elektrische Zahnbürste (1) beschrieben, die ein Griffteil (2) und ein Bürstenteil (3) aufweist. In dem Griffteil (2) ist ein Elektromotor (8) untergebracht. Des weiteren ragt aus dem Griffteil (2) eine Welle (20) heraus, die mit dem Elektromotor (8) gekoppelt ist. Das Bürstenteil (3) ist auf das Griffteil (2) aufsteckbar. Des weiteren ist an dem Bürstenteil (3) ein mit der Welle (20) koppelbarer Borstenträger (26) gehalten, von dem eine Vielzahl von Borsten (4) abstehen. Im eingeschalteten Betriebszustand führt der Borstenträger (26) eine Drehbewegung (49) sowie eine Hubbewegung (50) aus, wobei die Frequenz der Hubbewegung (50) größer, vorzugsweise wesentlich größer ist als die Frequenz der Drehbewegung (49). Die Hubbewegung (50) stellt eine Stocherbewegung der Borsten (4) dar, mit der Plaque von den Zahnoberflächen abgelöst wird. Mit Hilfe der Drehbewegung (49) wird die abgelöste Plaque von den Zahnoberflächen weggewischt.

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Electric Toothbrush

This invention relates to an electric toothbrush with a handle which houses an electric motor, and with a shaft that is connected to and driven by said electric motor and can be coupled to a brush attachment provided with a bristle head which is rotary about an axis for generating an oscillating or continuous rotary movement of the bristle head.

An electric toothbrush of this type is known from international patent application WO 94/12121 A1. In that particular toothbrush, the brush attachment incorporates a rotary brush shaft which can be driven in alternating fashion. The bristle head is pivotally mounted on the brush attachment, with the axis of rotation of the brush shaft and the axis of rotation of the bristle head extending in an approximately perpendicular relation to each other. The embodiment of FIG. 9 of international patent application WO 94/12121 A1 features a T-adaptor that is comprised of a longitudinal rod and a cross pin. The longitudinal rod is seated in a bore in the brush shaft roughly parallel with, but outside its axis of rotation. The cross pin is seated in a bore in the bristle head roughly parallel with, but outside its axis of rotation. The longitudinal rod is mounted for rotation in its bore and is displaceable in the direction of the axis of rotation of the brush shaft. The cross pin, on its part, is mounted for rotation in its bore but is prevented from moving in its bore in the direction of the axis of rotation of the bristle head. Alternating the direction of rotation of the brush shaft around its axis of rotation causes the bristle head to follow with an alternating rotary movement around its axis of rotation. However, because of the non-displaceable arrangement of the cross pin in its bore, the bristle head moves in a reciprocating stroke fashion. This stroke movement takes place in a direction parallel with the axis of rotation of the bristle head. The frequency of the alternating rotary movement of the



bristle head is identical to the frequency of the reciprocating stroke movement of the bristle head.

5 The reciprocating stroke movement of the bristle head causes the bristles to act like pokes and picks which makes it possible to loosen plaque from a user's dental surfaces. The alternating rotary movement of the bristle head causes the bristles to work like wipers which can remove especially plaque that has been loosened from the dental surfaces by the poking movement. The combination of these movements provides for good
10 cleaning of the user's teeth.

This prior known design, however, is relatively complex, requiring the added consideration that the mechanical components which produce the bristle head's stroke movement are located directly underneath the bristle head. During brushing, this
15 part of the brush attachment is penetrated by toothpaste, saliva or water, and it is especially the toothpaste with its abrasive particles that leads to a relatively quick wear of the mechanically moved parts. Moreover, only the bristle head itself, and not the entire brush attachment performs an additional reciprocating stroke movement which some users consider to be
20 unpleasant. Finally, the particular structural configuration of this known electric toothbrush design necessitates a rigid coupling of the frequency of the bristle head's reciprocating stroke movement to the frequency of the oscillating rotary movement of the bristle head. That does not make it possible, for
25 example, to further increase the stroke frequency of the bristle head by simple mechanical means so as to obtain more effective poking of the bristles on the dental surface, while maintaining a constant frequency of the oscillating rotary movement. This rigid, phase-locked coupling of the two movements of the bristle
30 head causes the bristle head to vibrate in a certain way which users find bothersome, and which makes it more difficult to



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accurately position the bristles' free ends on the dental surface.

It is an object of the present invention to provide an electric toothbrush of the type initially referred to, which further improves dental cleaning.

5

According to one aspect of the present invention there is provided an electric toothbrush with a handle which houses an electric motor, and with a shaft extending from the handle along a longitudinal axis, said shaft being operatively connected to and driven by said electric motor and being adapted for coupling to a brush attachment provided with a bristle

10 head, which is rotatable about an axis transverse to said longitudinal axis for generating an oscillating or continuous rotary movement of the bristle head, characterised in that the brush attachment coupled to the handle performs an oscillatory swivel or stroke movement or similar movement in a direction which is essentially parallel to said axis.

15

By virtue of this approach, it is no longer necessary to position components which serve to produce the swivel or stroke movement in the brush attachment itself, since the entire shaft is subjected to a swivel, stroke or similar motion component inside the handle, which is necessary for generation of the stroke movement of the bristle head. Typically, the handle is hermetically sealed off against the ingress of toothpaste, moisture or the like, which

20 prevents premature wear of the mechanical parts located inside the handle. Also, the entire brush attachment that is snapped onto the shaft and/or the shaft is set in this swivel or stroke motion, which the majority of users find pleasant. Finally, it is possible to freely select the frequency of the swivel, stroke or similar movement of the frequency to that of the oscillating rotary movement of the bristle head.

25

In a particularly advantageous first configuration of this invention, the brush attachment performs a swivel or stroke movement or similar movement around an axis, which extends in a direction essentially perpendicular to the axis that extends in the longitudinal direction of the shaft. In particular, the brush attachment can be mounted in the handle in

30 such a way as



to swivel about the axis in rocker-like fashion or the like. In the context of this description, the term swivel is to be understood as a movement of the brush attachment and/or the shaft over its entire length, for example, about a swivel axis, while
5 the term stroke refers to the movement of the brush attachment and/or the shaft or an end section of the shaft. For instance, while the brush attachment and/or the shaft in its entirety swivels rocker-like, the movement of the end points of the rocker, especially in the case of an elongated lever arm, can be
10 viewed as a type of stroke movement. For improved dental cleaning it is ultimately of importance that the bristles follow a sort of poking movement, meaning a movement essentially in the direction of the longitudinal axis of the bristles, that is, the longitudinal axis or axis of rotation of the bristle head, which
15 is essentially brought about by the stroke movement of the free end of the brush attachment and/or the shaft.

In another embodiment of this invention, it has been found to be eminently advantageous to arrange the swivel axis about which the brush attachment and/or the shaft perform the swivel
20 movement in the handle. This is a simple design approach enabling the bristles of the bristle head to be set in a rotary movement about the axis of rotation of the bristle head and in a stroke movement in the longitudinal direction of this axis.

It has also been found desirable to set the frequency of
25 the swivel or stroke movement at a higher level, preferably by a factor of about two to three, than the frequency of the rotary movement.

Advantageously, the direction of movement of the rotary movement and the direction of movement of the swivel or stroke
30 movement are oriented at substantially right angles to each other.



The amplitude of the swivel or stroke movement, in particular of the bristle head, that is, the bristle tips, is in the range of between about ± 0.02 mm and about ± 0.2 mm, and preferably about ± 0.05 mm.

5 In a preferred embodiment, the frequency of the rotary movement is set at about 60 to 70, and preferably about 65 Hz, while the frequency of the swivel or stroke movement is set at about 120 to 210 Hz, in particular about 165 Hz.

10 Preferably, the particular frequencies of the rotary movement and the swivel or stroke movement in relation to each other are so selected that phase coincidence of the heterodyne oscillation does not occur until after a plurality of oscillatory cycles, and in particular after more than four such cycles. Given different frequencies of the two motions of the bristle
15 head, the curve of the resultant movements takes on a very irregular slope. This irregular curve repeats itself after a certain number of cycles of the two individual movements. According to the prior art, the stroke movement has a frequency twice as high as the oscillating rotary movement, so that the
20 irregular curve repeats itself with the periodicity of the oscillation cycles. Such frequent occurrence of the irregular motion curve and the attendant unsteadiness in the movement of the bristle head do not always make it easy for the user of the toothbrush to positively and firmly press the bristles' free
25 ends against the teeth, or to accurately position the bristles on the dental surfaces. If, however, the frequency ratio of the rotary movement to the swivel- or stroke-movement frequencies is selected in a way that, after canceling out identical errors, the quotient displays two preferably large prime numbers or
30 prime-number products, the curve irregularities of the overall movement of the bristle head occur quite seldom. The less often these irregularities are encountered, the smoother the motion of the bristle head and the easier the exact positioning of the



bristles' free ends on the user's teeth. Individual prime-number quotients for said frequency ratios may, for instance, be 23/9, 13/5, 27/10, 28/11, 34/13, 171/65. Given these conditions, the quotient from the two frequencies, and thus the mutual relation of the two frequencies is changed in a minor way only, while phase coincidence occurs after a varying, large number of oscillations or oscillatory cycles, these being 9.5, 10, 11, 13, 65. The greater the number of oscillation cycles, the smoother and more regular the resultant motion of the bristle head.

All in all, it has been found that such frequency differential of the stroke movement and the rotary movement significantly improves the cleaning effect on a user's teeth. This is attributable to the fact that, on the one hand, the higher frequency of the stroke movement of the bristle head intensifies the poking and picking movement of the bristles, thus producing significantly enhanced loosening of plaque from the user's dental surfaces. On the other hand, the wiping motion does not take place at the same high frequency and too rapid a wiping of the bristles over the dental surfaces is thus avoided. Instead, the wiping motion takes place at a lower frequency, which permits positive removal of the loosened plaque from the dental surfaces and, in fact, helps loosen additional plaque. Accordingly, while the higher frequency of the stroke movement of the bristle head has a beneficial effect on the loosening of plaque from a user's dental surfaces, the lower frequency of the rotary movement of the bristle head assures positive removal of the loosened plaque by wiping, in addition to loosening more plaque.

In an advantageous further configuration of this invention, the ratio of the frequencies of the rotary movement and the stroke movement is a finite value, or a periodic fraction, or a non-periodic fraction. It is thus possible to freely select the frequency ratio of the rotary movement to the stroke movement



within this range. For example, given a predetermined frequency for the rotary movement, it is a simple matter to set the higher frequency for the stroke movement at the desired value by selecting the appropriate frequency ratio.

5 In an advantageous further feature of this invention, the frequencies of the rotary movement and the stroke movement are independent of each other. By suitable structural means, the frequency of the rotary movement and the frequency of the stroke movement can be freely set at the respectively desired value,
10 absolutely independent of each other.

In an advantageous configuration of this invention, the rotary movement and the stroke movement of the bristle head are generated by the electric motor. Only one electric motor is used. The different frequencies for the rotary movement and,
15 respectively, the stroke movement can be produced by this electric motor with the aid of a gear system or similar device, for example. In that case, the ratio of the frequency of the rotary movement to that of the stroke movement is determined by the gear ratio. It is also possible, however, to generate these
20 frequencies without a gear system. This can be accomplished, for instance, by means of a coupling or similar device which is interpositioned, for example, between the stroke movement and the lower-frequency rotary movement.

In another advantageous configuration of this invention,
25 the rotary movement is generated by the electric motor, while the stroke movement is generated by other independent drive means. Accordingly, the rotary movement and the stroke movement are each operated by mutually independent drive means. This makes it easily possible to set the frequency of the rotary
30 movement and the frequency of the stroke movement at any desired value, completely independent of each other. By the same token,



the ratio of the rotary-movement and stroke-movement frequencies can also be set at any desired value.

It is particularly desirable to generate the stroke movement by an additional electric motor, or an electromagnetic oscillator, or a piezoelectric actuator. While the rotary movement is generated by the electric motor, the stroke movement is then produced by the second drive system, preferably a second electric motor. In that case, appropriate controls for the two electric motors permit mutually independent selection of the frequency for the rotary movement and the frequency for the stroke movement.

In an advantageous configuration of this invention, the stroke movement of the bristle head can be switched off when the force acting on the bristles exceeds a certain level. As explained in the foregoing, the stroke movement of the bristle head produces a poking effect of the bristles which serves to loosen plaque from the dental surfaces. According to this invention, the higher frequency of the stroke movement intensifies that poking effect. It is a known fact that many users of electric toothbrushes often have a tendency to press the bristle ends against their dental surfaces with too much force. While this further strengthens the poking action of the bristles, it is also a known fact that excessive force applied to the dental surfaces or to the gums can cause damage. To avoid such damage, the stroke movement switches itself off as soon as the force applied to the bristles exceeds a predetermined level. Potential damage is thus safely avoided. Also, the deactivation of the stroke movement alerts the user in tactile and/or audible fashion to the fact that he is pushing the bristles against his dental surfaces with too much pressure. This is due to the fact that the user feels the poking movement of the bristles in the form of vibrations on his dental surfaces, the stoppage of which tells him that the poking action has been turned off. This



shut-off feature of the stroke movement thus provides a particularly advantageous safety and alert function for the user.

5 In another advantageous configuration of this invention, the stroke movement can be switched off by the user. Accordingly, the user is free at any time to activate or deactivate the stroke movement of the bristle head, and thus the poking action of the bristles on his dental surfaces. This may be useful, for instance, when the user merely wants to massage his gums, in which case the poking action would be unpleasant. This
10 feature allows the user to temporarily switch off the poking action.

In an advantageous configuration of this invention, the rotary movement is an alternating motion around an axis that is approximately parallel with the bristles of the bristle head.
15 It has been found that this produces a particularly good wiping motion of the bristles which permits especially effective removal of loosened plaque, and which also helps loosen additional plaque from the dental surfaces.

20 In another advantageous configuration of this invention, the stroke movement of the bristle head is oriented approximately parallel with the bristles. When the user places the bristles on his dental surfaces in roughly perpendicular fashion, this will cause the poking action of the bristles to be applied on the teeth in equally roughly perpendicular fashion.
25 This enables the poking action of the bristles to be particularly good and effective. It further enhances the loosening of plaque, and thus the cleaning of the dental surfaces.

30 In an advantageous configuration of this invention, the shaft and/or the brush attachment coupled to the handle constitute integral parts of a rocker arm which is mounted inside the handle in such a way as to swivel approximately perpendicular to the axis of the rocker arm. When the rocker arm swivels, the



bristle head mounted at the free end of the brush attachment performs a reciprocating stroke motion. The roughly perpendicular arrangement of the axis of the rocker arm relative to the shaft causes the stroke movement of the bristle head to be approximately or essentially in the direction of the bristles. Furthermore, suitable selection of the distance between the bristle head and the rocker-arm axis can cause the stroke movement of the bristle head to be approximately parallel with the direction in which the bristles extend. This produces the aforementioned effective poking action of the bristles, and thus results in better cleaning of the dental surfaces. Configuring the shaft and the brush attachment as parts of a rocker arm thus offers a particularly convenient possibility of obtaining the desired stroke motion of the bristle head in a simple and cost-effective manner.

In an advantageous further feature of this invention, the electric motor is coupled to means for generating vibrations, said means acting on a cantilever that protrudes from the rocker arm opposite the brush attachment. The rocker arm is thus vibrated, that is, set in a very rapid swivel motion of the rocker arm around its axis. As a result, the bristle head at the free end of the brush attachment performs a very rapid reciprocating stroke motion. When the user applies the bristles of the bristle head to his dental surfaces, this stroke movement of the bristle head results in the aforementioned poking action of the bristles which loosens plaque from the dental surfaces. The rocker arm and the above-described vibration effect thus produce the poking action of the bristles in a particularly simple and practical fashion.

In an advantageous configuration of this invention, said vibration is generated by means of an eccentric element mounted on the motor shaft of the electric motor and bearing on the cantilever of the rocker arm. The eccentric element on the



motor shaft thus generates the vibration, and since the eccentric element bears on the cantilever, the vibration is transferred to the rocker arm. This provides an extremely simple approach to setting the rocker arm in vibratory motion, thus
5 producing the poking action of the bristles. It requires very few additional components, involving the added effect that they are especially inexpensive to make. Still further, the configuration of the eccentric element offers an easy way to select the mode and intensity of the vibration.

10 In an advantageous further feature of this invention, the cantilever is provided with a sliding shoe or a roller on which bears the above-mentioned eccentric element. Any friction of the eccentric element on the cantilever is thus reduced, or altogether eliminated. The aforementioned vibration is thus
15 generated without wear, which is especially useful given daily operation.

In another embodiment, it may be of advantage for an eccentric sleeve or the like carrying a ball bearing or the like to be mounted on the motor shaft. These approaches afford ease and
20 non-complexity of manufacture of an eccentric element.

In a further advantageous configuration of this invention, the eccentric element is provided in the form of a bearing, in particular a ball bearing having an eccentric inner race mounted on the motor shaft. The cantilever of the rocker arm bears on
25 the outer race of the ball bearing. The use of this ball bearing prevents any friction losses between the motor shaft and the cantilever. Vibration is thus generated without any wear. The degree of eccentricity of the inner bearing race permits simple selection of the mode and strength of the vibration. This is a
30 particularly strong and sturdy means for vibrating the rocker arm and generating the poking action of the bristles.



It is also possible to provide the cantilever with a roller which bears on the outer race of the ball bearing. This will further reduce any friction. In this case the added possibility exists for the outer race of the ball bearing to be equally
5 eccentric. This produces the superposition of two eccentric motions, that of the inner race and that of the outer race of the ball bearing. In this manner, additional modulation of the vibration of the rocker arm and thus of the poking action of the bristles is made possible.

10 In an advantageous configuration of this invention, the vibration-generating element is an eccentric roller which is attached to the cantilever and bears on the motor shaft. In this configuration, the eccentric element is thus part of the cantilever. The motor shaft does not support any such compo-
15 nent. The eccentric roller only bears on the motor shaft, causing the vibration of the rocker arm, and with it the poking action of the bristles, to be generated in this manner. This configuration requires but few additional components, permitting simple and cost-effective manufacture. The friction between the
20 motor shaft and the eccentric roller is minor so that this configuration largely avoids any wear, lending itself to everyday use.

In an advantageous configuration of this invention, a spring element is provided, in particular a bending spring, a
25 helical compression spring or the like, by means of which the cantilever is urged against the eccentric element of the motor shaft, or the eccentric element of the cantilever against the motor shaft. The bending spring thus ensures that the eccentric element always bears on the cantilever or, respectively, on the
30 motor shaft, thus assuring vibration at all times. The selection of the bending spring determines the amount of pressure with which the eccentric element bears on the cantilever or on the motor shaft, respectively. This makes it possible to



minimize the braking effect, and thus the load, of the vibration system on the electric motor. As an alternative, a leaf spring or a helical spring or the like may also be used.

5 In an advantageous further feature of this invention, the cantilever is lifted off the eccentric element on the motor shaft, or the eccentric element of the cantilever is lifted off the motor shaft, as applicable, when a force applied to the bristles of the bristle head is exceeded. Suitable selection of the spring force permits selection of the pressure with which
10 the spring urges the cantilever against the eccentric element on the motor shaft, or the eccentric element on the cantilever against the motor shaft. When that pressure level is exceeded, the cantilever will be lifted off the eccentric element, or the eccentric element off the motor shaft. As a result, the rocker
15 arm no longer vibrates and the bristle head stops its reciprocating stroke movement. As stated above, this constitutes a safety and alert function for the user in terms of excessive pressure exerted by the bristles on his dental surfaces. The spring thus provides the above-mentioned safety and alert func-
20 tion in a very simple and low-cost, yet safe and effective way.

In an advantageous configuration of this invention, the rocker arm is provided with a tube on the side close to the brush attachment, said tube holding the shaft and extending from the handle by an elastic means. The tube with the rocker arm
25 held in it constitute a free end of the rocker arm. This end extends from the handle. The part of the tube that protrudes from the handle can accommodate the brush attachment. As explained above, in the activated operating condition the rocker arm is set in a vibratory motion which, in turn, produces the
30 reciprocating stroke movement of the bristle head. To prevent the protrusion of the tube from the handle from interfering with this stroke movement, the tube is connected with the handle in an elastic fashion. This permits unimpeded propagation of the



rocker arm vibration, and equally unimpeded reciprocating stroke movement of the bristle head. The elastic extension of the tube from the handle thus provides for proper functioning of the stroke movement in a simple, yet effective manner. As an added benefit, the elastic connection securely prevents dirt and particularly water from penetrating into the interior of the electric toothbrush.

In another advantageous configuration of this invention, the motor shaft of the electric motor and the shaft which is part of the rocker arm assembly are connected with each other by way of a four-bar linkage. The motor shaft of the electric motor turns in a continuous rotational mode. By means of the four-bar linkage, this rotary motion of the motor shaft is converted into an alternating rotary movement of the shaft forming the rocker arm. As a result, the bristle head which is coupled to this shaft rotates in alternating fashion. This four-bar linkage offers a well-established, simple and low-cost approach to the rotary conversion described. The four-bar linkage also has the advantage that the vibration of the shaft does not affect the alternating rotation of the shaft. In particular, the four-bar linkage compensates for the swivel movements of the shaft in such a way as to essentially cancel them out, so that they do not negatively affect the motor shaft of the electric motor. This compensation for the swivel movements of the shaft is accomplished by the connecting joints of the individual components of the four-bar linkage, in particular by virtue of the components' play in relation to one another. The alternating rotary movement generated by the four-bar linkage is thus independent of the generation of the vibratory movement.

In another advantageous configuration of this invention, a frame is provided which supports the rocker arm and which is itself housed inside the handle. This prevents direct transmission of the vibration generated by the rocker arm to the handle.



This makes the use of the electric toothbrush more pleasant, and thus constitutes an advantageous feature in terms of user comfort. This also makes it possible during production of the electric toothbrush to test the rocker arm, in simple fashion
5 and outside the handle, for proper functioning, and thus for its vibrating action. Similarly, repairs and/or corrections are easily made on the frame and the components it supports while outside the handle. This is a substantial benefit in terms of the cost of manufacture and maintenance of the electric tooth-
10 brush.

In an advantageous further feature of this invention, the electric motor is mounted on the frame. As described above, this substantially facilitates the manufacture, testing and maintenance of the electric toothbrush, and thus has a benefi-
15 cial effect on the cost of the product.

In a still further advantageous feature, the frame is retained in the handle in elastic fashion. In this manner, the frame is elastically supported inside the handle. As a result, the vibration generated by the rocker arm is prevented from
20 being transferred from the frame to the handle, which makes operation more pleasant and further adds to user comfort.

In this arrangement, it has proven to be advantageous for the shaft, for instance, to be mounted in the handle so as to be permitted to swivel with respect to the axis and to be connected
25 to the brush shaft by means of a balancing coupling. In this case, only the rocker arm is caused to perform a swivel or stroke movement or the like, while the shaft is pivotal only about its longitudinal axis.

It has proven to be advantageous in this arrangement that
30 one coupling member, in particular the tube of the handle, is mounted in the handle so as to be permitted to swivel with respect to the swivel axis.



The shaft for driving the bristle head around the axis of rotation may perform, for instance, an oscillating or continuous rotary movement around the longitudinal axis or, alternatively, a reciprocating stroke movement in the direction of the longitudinal axis. From the design point of view, the means for generating the swivel or stroke movement of the bristle head are practically independent of the way in which the bristle head is set in rotary motion.

Further features, advantages and application possibilities of this invention will become apparent from the subsequent description of embodiments illustrated in more detail in the accompanying drawings. In this context, all features described and/or depicted, whether individually or in any reasonable combination, constitute the subject-matter of this invention, irrespective of their summary in the claims and the cross-references of the latter.

In the drawings,

FIG. 1 is a schematic longitudinal sectional view of an electric toothbrush illustrating a first embodiment thereof;

FIG. 2 is a schematic cross-sectional view of the electric toothbrush of FIG. 1, taken along the plane A-A of FIG. 1;

FIG. 3 is a schematic cross-sectional view of the electric toothbrush of FIG. 1, taken along the plane B-B of FIG. 1;

FIG. 4 is a schematic longitudinal sectional view of an electric toothbrush illustrating a second embodiment thereof;

FIG. 5 is a schematic longitudinal sectional view of an electric toothbrush illustrating a third embodiment thereof.



FIGS. 1 to 3 show a first embodiment of an electric toothbrush 1 serving to clean a user's teeth, in particular to remove plaque from dental surfaces.

5 The electric toothbrush includes a roughly cylindrical, elongated handle 2. A brush attachment 3, itself in roughly cylindrical, elongated form, can be mounted on the handle 2. The diameter of the handle 2 is so chosen that a user can hold the electric toothbrush 1 by the handle 2 securely in his or her hand. The diameter of the brush attachment 3 is smaller than
10 the diameter of the handle 2 to permit easy insertion of the brush attachment 3 in the user's oral cavity.

At the free end of the brush attachment 3, a multiplicity of bristles 4 protrude from the bristle head, serving to clean the user's teeth.

15 The handle 2 incorporates a housing 5 which accommodates a frame 6. The frame 6 is elongated and partly cylindrical, extending over almost the entire length of the housing 5, and thus of the handle 2. At its end facing the brush attachment 3, the frame 6 is elastically held in place in the housing 5 by means
20 of cushions 7 consisting of plastic or rubber or a similar material.

Attached to the frame 6 are an electric motor 8, a storage battery 9 and additional electronic components such as a charging coil 10 and the like. These components are arranged
25 preferably one behind the other in the longitudinal direction of the handle 2. Also attached to the frame 6 is a rocker arm 11 which can swivel around an axis 12. The rocker arm 11 with the axis 12 is located in the section of the handle 2 that faces the brush attachment 3. Part of the rocker arm 11 protrudes from
30 the handle 2.



The rocker arm 11 incorporates a tube 13, a cantilever 14, and two support stems 15, 16. The tube 13 of the rocker arm 11 extends through an opening 17 in the end of the handle 2 facing the brush attachment 3, and protrudes from the handle 2.

5 Located between the tube 13 and the housing 5 of the handle 2 is an annular diaphragm 18 made of plastic or rubber or a similar material by way of which the tube 13 of the rocker arm 11 extends elastically from the handle 2. Holding and retaining the tube 13 in the housing 5 of the handle 2 is a clamp 19 which

10 surrounds the diaphragm 18 in ring-shaped fashion.

At least that part of the tube 13 that extends from the handle 2 has a cross section that is contoured on the outside. It is on this protruding part of the tube 13 that the brush attachment 3 can be mounted. At least at its end that faces the

15 handle 2, the brush attachment 3 has a cross section that is contoured on the inside in such a way as to match the outer contour of the tube 13. The matching contours are configured in such a way that the brush attachment 3 can be mounted on the handle 2 in only one particular angular position. For example,

20 the contour may have a star-shaped, or triangular, or similar configuration.

When mounted on the tube 13 of the rocker arm 11, the brush attachment 3 becomes an integral part of the rocker arm 11.

Located in the tube 13 of the rocker arm 11 is a shaft 20

25 having one end thereof pivotally mounted at the free end of the tube 13 protruding from the handle 2, while its other end is pivotally mounted in the support stem 15. The shaft 20 extends roughly in the longitudinal direction of the handle 2 and the brush attachment 3, defining an axis 21. The shaft 20 constitutes another component of the rocker arm assembly 11. The

30 shaft 20 protrudes from the tube 13 where, at its free end, it has a cross section that is contoured on the outside.



The axis 12 of the rocker arm 11 and the axis 21 of the shaft 20 extend roughly perpendicular to each other.

The tube 13 of the rocker arm 11 accepts the brush attachment 3. The brush attachment 3 includes a support tube 22 in which a brush shaft 23 is pivotally mounted. When the brush attachment 3 is mounted, the brush shaft 23 is concentric with the axis 21; at its end facing the handle 2, it has a recess 24. This recess 24 has a cross section with an inside contour which corresponds to the outer contour of the shaft 20 that protrudes from the tube 13. The matching contours are configured in a way that the shaft 20 can be inserted in the recess 24 in several angular positions. For example, the contour may be square.

The free end of the support tube 22, and thus the free end of the brush attachment 3, holds a receptacle 25 which houses a bristle head 26 to which the bristles 4 are secured. The bristle head 26 is disk-shaped and mounted for rotation about an axis 27. The axis 27 extends through the center of the disk of the bristle head 26, and the bristles 4 extend away from the bristle head 26, approximately parallel with the axis 27.

The axis 27 of the bristle head 26 extends roughly perpendicular to the axis 21 of the shaft 20, and also approximately perpendicular to the axis 12 of the rocker arm 11.

By way of two bevel gear segments 28, 29, an alternating rotary movement of the brush shaft 23 around the axis 21 is translatable into an alternating rotary movement of the bristle head 26 around the axis 27.

It should be noted that said translation of the alternating rotary movement from the brush shaft 23 to the bristle head 26 can be accomplished in other ways as well. It is possible, for example, to perform this translation in accordance with the



5 aforementioned prior art described in the international patent application WO 94/12121 A1, particularly as shown in FIGS. 1 and 7 of that printed specification. To that extent, express reference is made in this application to the disclosure content of WO 94/12121 A1.

10 Between the rocker arm 11 and the electric motor 8, the handle 2 houses a four-bar linkage 30. The electric motor 8 has a motor shaft 31 which extends approximately parallel with the axis 21 of the shaft 20 and protrudes from the electric motor 8 in the direction of the rocker arm 11. Rotationally fixed on the motor shaft 31 is a pinion 32 which meshes with a spur gear 33. The spur gear 33 is mounted for rotation about an axis 34 which extends approximately parallel with the motor shaft 31. A tenon 35 carried in a support stem 36 that is mounted on the electric motor 8 extends from the spur gear 33 concentric with the axis 34.

20 On the side of the spur gear 33 opposite the tenon 35, a drive crank 37 is attached to the spur gear 33, extending approximately parallel with, but at a distance from the axis 34. This drive crank 37 is also rotatably mounted in the support stem 16 of the rocker arm 11 by way of a connector 38 and a tenon 39. The tenon 39 is arranged concentrically with the axis 34.

25 A connecting rod 40 is rotatably mounted on the drive crank 37. As becomes apparent in particular from FIG. 2, the connecting rod 40 is swivel-connected to a driven crank 42 by means of a pin 41. Between the tube 13 and the support stem 15, the driven crank 42 is secured to the shaft 20 of the rocker arm 11 in a manner preventing relative rotation.

30 A ball bearing 43 is mounted on the motor shaft 31 of the electric motor 8. The ball bearing 43 has an eccentric inner race 44 and a concentric outer race 45. It is with the



eccentric inner race 44 that the ball bearing 43 is seated on the motor shaft 31. The eccentric inner race 44 thus acts as the eccentric element. The concentric outer race 45 is in abutting engagement with the free end of the cantilever 14 of the rocker arm 11.

As becomes apparent in particular from FIG. 3, the frame 6 is provided with openings 46, 47 in which the free ends of a bending spring 48 take support. The bending spring 48 is positioned in a way that it bears on the cantilever 14 of the rocker arm 11, urging it against the outer race 45 of the ball bearing 43. The pressure with which the bending spring 48 urges the cantilever 14 against the ball bearing 43 is a function of the spring constant of the bending spring 48.

When the electric toothbrush 1 of FIGS. 1 to 3 is switched on, the motor shaft 31 of the electric motor 8 is set in rotating motion. By means of the four-bar linkage 30, this continuous rotation is translated into an alternating rotary movement of the shaft 20 around the axis 21. When the brush attachment 3 is mounted, this alternating rotary movement is transferred, by way of the bevel gear segments 28, 29, to the bristle head 26 which thus turns in an equally alternating rotary movement 49 around the axis 27.

The bristle head 26 turns in an alternating rotary movement 49 within an angle of rotation the range of which may be in particular between about $\pm 15^\circ$ and about $\pm 40^\circ$. The overall travel can thus be between about 30° and about 80° . Preferably, the range of the angle of rotation is about ± 30 degrees and the overall travel is thus about 60 degrees. However, angles of rotation of up to about $\pm 90^\circ$ are entirely feasible.

The frequency of the alternating rotary movement 49 of the bristle head 26 can be between about 50 Hz and about 80 Hz. Preferably, the frequency is about 63 Hz.



As mentioned, when the electric toothbrush 1 of FIGS. 1 to 3 is in the operating mode, the motor shaft 31 of the electric motor 8 rotates in continuous fashion. Due to its eccentric inner race 44, the entire ball bearing 43 is set in a vibratory motion. Accordingly, the eccentric inner race 44 serves to generate the vibration. The cantilever 14, urged against the outer race 45 of the ball bearing 43 by the bending spring 48, transfers this vibration to the rocker arm 11. As a result, the rocker arm 11 is set into a vibrating swivel motion around the axis 12.

As explained above, the brush attachment 3, when mounted, constitutes an integral part of the rocker arm 11. Consequently, the brush attachment 3, along with the bristle head 26, is equally set into a vibrating swivel motion around the axis 12. Since the axis 12 is oriented approximately at right angles to the axis 27, the bristle head 26 executes a reciprocating stroke movement 50 in a direction approximately parallel with the axis 27. This roughly parallel alignment of the bristles 4 and the axis 27 ultimately causes the bristles 4 to deliver a poking action in the direction in which the bristles extend.

The travel of the reciprocating stroke 50 of the bristle head 26, and thus the poking action of the bristles 4, can be over a distance in the range between about ± 0.02 mm and about ± 0.2 mm. The total travel can thus be between about 0.04 mm and about 0.4 mm. Preferably, this travel movement of the stroke 50 in either direction is about ± 0.05 mm, and the overall travel is thus about 0.1 mm.

The frequency of the reciprocating stroke movement 50 of the bristle head 26, and thus of the poking action of the bristles 4, can be between about 130 Hz and about 200 Hz. Preferably, this frequency amounts to about 164 Hz.



The frequency of the reciprocating stroke movement 50 is thus higher, and preferably substantially higher, than the frequency of the alternating rotary movement 49.

5 The rotary movement 49 and the stroke movement 50 of the bristle head 26 are both generated by the electric motor 8. The frequency of the reciprocating stroke movement 50 of the bristle head 26 corresponds directly to the rotational frequency of the electric motor 8. The frequency of the alternating rotary movement 49 of the bristle head 26, however, is determined by the
10 rotational frequency of the electric motor 8 as modulated by the four-bar linkage 30. Accordingly, the frequency ratio of the alternating rotary movement 49 to the reciprocating stroke movement 50 is a finite value, or a periodic fraction, or a non-periodic fraction.

15 When the electric toothbrush 1 of FIGS. 1 to 3 is switched on for the purpose of cleaning a user's teeth, the user applies the bristles 4 to his dental surfaces. As a result, a certain force acts on the bristles 4, which is indicated in FIG. 1 by reference numeral 51.

20 As has been explained, the cantilever 14 of the rocker arm 11 is urged against the outer race 45 of the ball bearing 43 by means of the bending spring 48. The cantilever 14 also bears against that side of the ball bearing 43 on which the bristle head 16 is located. Now if the user applies a force 51 to the
25 bristles 4 of the bristle head 26 which exceeds a certain level, the result will be that the cantilever 14 of the rocker arm 11 is lifted off the outer race 45 of the ball bearing 43, against the spring action of the bending spring 48. The vibration generated by the ball bearing 43 is thus no longer transferred
30 to the rocker arm 11 nor, consequently, to the bristle head 26 and the bristles 4. Accordingly, if and when the force 51 exceeds that certain level, the retraction of the cantilever 14



away from the ball bearing 43 will turn off the reciprocating stroke movement 50 of the bristle head, and with it the poking action of the bristles 4.

5 The specific pressure level of the force 51 at which the cantilever 14 is lifted off the ball bearing 43 can be predetermined by the selection of the appropriate spring constant of the bending spring 48. The greater the spring constant, the stronger the force with which the bending spring 48 urges the cantilever 14 against the ball bearing 43, and the greater the
10 certain amount of force 51 that is needed to lift the cantilever 14 off the ball bearing 43.

The specific level of the force 51 may be in the range of about 1.5 Newton to about 4.0 Newton. Preferably, the specific level of the force 51 is at about 2.0 Newton.

15 In addition or as an alternative thereto, it is possible to provide mechanical devices which serve to lift the cantilever 14 of the rocker arm 11 off the outer race 45 of the ball bearing 43. Devices of this type allow for the switching-off of the reciprocating stroke movement 50 of the bristle head 26, and
20 thus of the poking action of the bristles 4, independent of the force 51 at which the user presses the bristles 4 against his dental surfaces. Such a device may, for instance, be a lever that can be actuated by the user and which enables the cantilever 14 to be lifted off the ball bearing 43. This gives the
25 user the option of activating and deactivating the reciprocating stroke movement of the bristle head 26 at will.

FIG. 4 illustrates a second embodiment of an electric toothbrush 52, which in its configuration and function is largely similar to the electric toothbrush 1 of FIGS. 1 to 3.
30 The only difference lies in the approach to generating the vibration of the rocker arm 11, which in the electric toothbrush of FIG. 4 is not brought about by a ball bearing with an eccen-



tric inner race. Therefore, the following only describes the components which differ from those in the electric toothbrush 1 of FIGS. 1 to 3. Like components are assigned like reference numerals.

5 In the electric toothbrush 52 of FIG. 4, the vibration is generated by means of an eccentric element 53 which is secured to the motor shaft 31 of the electric motor 8 in a manner preventing relative rotation. Said eccentric element may, for instance, be in the form of a wheel or similar element which is
10 either seated in off-center fashion or displays an eccentric circumference. The free end of the cantilever 14 of the rocker arm 11 is provided with a roller 54 which is mounted for rotation about an axis 55 that extends approximately parallel with the motor shaft 31. The roller 54 bears on the eccentric
15 element 53 and, as the motor shaft 31 rotates in continuous fashion, it rolls with its circumference along the circumference of the eccentric element 53. As a result, when the electric toothbrush 52 is in the operating mode, the rocker arm 11 is vibrated by the eccentric element 53 and the roller 54 revolving
20 on it. This vibration, as explained above, is transferred to the bristle head 26 where it generates the reciprocating stroke movement 50.

As an alternative to the roller 54, a sliding shoe may be provided which slides along the circumference of the eccentric
25 element 53.

Another alternative approach involves the use of a ball bearing 43 as shown in FIGS. 1 to 3, with the roller 54 of FIG. 4 being in engagement with, and rolling along the circumference of, the outer race 45 of the ball bearing 43.

30 As another additional or alternative approach, the outer race 45 of the ball bearing 43 is not concentric as shown in FIGS. 1 to 3, but is instead eccentric. In particular when com-



bined with the roller 54, this will generate a vibration which is a composite of the vibration derived from the eccentric inner race 44, and the vibration generated by the eccentric outer race 45.

5 Another possible alternative is to use an eccentric wheel in lieu of the roller 54 mounted on the cantilever 14 as shown in FIG. 4. This may be accomplished by mounting the wheel off-center or providing it with an eccentric circumference. In this case it is not necessary to equip the wheel with any other component that would be mounted on the motor shaft 31 of the electric motor 8. The eccentric wheel bears directly on the motor shaft 31 and revolves on it as the motor shaft 31 rotates in continuous fashion. Due to the eccentric shape of the wheel, the rocker arm 11 is set in a vibratory motion which, in turn, produces the reciprocating stroke motion 50 of the bristle head 26, and with it the poking action of the bristles 4.

FIG. 5 illustrates a third embodiment of an electric toothbrush 56 which in terms of its structural concept and function is largely similar to the electric toothbrush 1 of FIGS. 1 to 3. The only difference is the location of the cantilever 14 of the rocker arm 11, which in the electric toothbrush of FIG. 5 is not on the same side as the bristle head 26. Therefore, the following describes only the components which differ from those in the electric toothbrush 1 of FIGS. 1 to 3. Like components are assigned like reference numerals.

In the electric toothbrush 56 of FIG. 5, the cantilever 14 of the rocker arm 11 bears on the outer race 45 of the ball bearing 43 on that side which is located opposite the bristle head 26. As a result, the cantilever 14 will always be in a state where the bending spring 48 urges it against the ball bearing 43. Even the force 51 acting on the bristles 4 will not lift the cantilever 14 off the ball bearing 43. In this case,



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the bending spring 48 only serves a biasing function. The reciprocating stroke movement 50 of the bristle head 26, and consequently the poking action of the bristles 4, remain in effect regardless of any force 51.

- 5 For space reasons it is necessary in the case of the electric toothbrush 56 of FIG. 5 to position the four-bar linkage 30 on the other side of the rocker arm 11, as compared with the electric toothbrush 1 of FIGS. 1 to 3.

As another possible alternative, the vibration and with it the reciprocating stroke
10 movement 50 of the bristle head 26, are not generated by the electric motor 8 as provided for in FIGS 1 to 5, but by an independent drive system. As a result, the frequency of the reciprocating stroke movement 50 of the bristle head 26, and hence the frequency of the poking action of the bristles 4, will be independent of the frequency of the alternating rotary movement 49 of the bristle head 26. The independent drive system for the stroke movement
15 50 may, for instance, be a second electric motor, or an electromagnetic oscillator, or a piezoelectric actuator.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or comprising" , will
20 be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS :

1. An electric toothbrush with a handle which houses an electric motor, and with a shaft extending from the handle along a longitudinal axis, said shaft being operatively connected
5 to and driven by said electric motor and being adapted for coupling to a brush attachment provided with a bristle head, which is rotatable about an axis transverse to said longitudinal axis for generating an oscillating or continuous rotary movement of the bristle head, characterised in that the brush attachment coupled to the handle performs an oscillatory swivel or stroke movement or similar movement in a direction which is essentially parallel
10 to said axis.
2. The electric toothbrush as claimed in claim 1, characterised in that the brush attachment performs a swivel or stroke movement or similar movement around an axis which extends in a direction essentially perpendicular to the axis that extends in the longitudinal
15 direction of the shaft.
3. The electric toothbrush as claimed in claim 2, characterised in that the axis is arranged in said handle.
- 20 4. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the frequency of the swivel or stroke movement is higher, preferably by a factor of about two to three, than the frequency of the rotary movement.
5. The electric toothbrush as claimed in any one of the preceding claims, characterised
25 in that the direction of movement of the rotary movement and the direction of movement of the swivel or stroke movement are oriented at substantially right angles to each other.
6. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the amplitude of the swivel or stroke movement is in the range of between ± 0.02 mm
30 and ± 0.2 mm, and is preferably about ± 0.05 mm.



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7. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the frequency of the rotary movement is about 60 to 70 Hz, and preferably about 65 Hz, and the frequency of the swivel or stroke movement is about 120 to 210 Hz, and is preferably about 165 Hz.

5

8. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the frequencies of the rotary movement and the swivel or stroke movement are selected in relation to each other to the extent that phase coincidence of the heterodyne oscillation does not occur until a plurality of oscillatory cycles.

10

9. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the ratio of the frequencies of the rotary movement and the stroke movement is a finite value, or a periodic fraction, or a non-periodic fraction.

15 10. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the frequencies of the rotary movement and the stroke movement are independent of each other.

11. The electric toothbrush as claimed in any one of the preceding claims, characterised
20 in that the rotary movement and the stroke movement of the bristle head are generated directly or indirectly by the electric motor.

12. The electric toothbrush as claimed in any one of the patent claims 1 to 10, characterised in that the rotary movement is generated by the electric motor, while the stroke
25 movement is generated by other independent drive means.

13. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the stroke movement is generated by an additional electric motor, or an electromagnetic oscillator, or a piezoelectric actuator.

30



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14. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the stroke movement of the bristle head automatically comes to a stop when the force acting on the bristles exceeds a certain level.

5 15. The electric toothbrush as claimed in claim 14, characterised in that means are provided which enable a user to select the individual setting of the force level.

16. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the stroke movement can be switched off by the user.

10

17. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the rotary movement is an oscillating motion that occurs around an axis the orientation of which is approximately parallel with the bristles of the bristle head.

15 18. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the stroke movement of the bristle head is oriented approximately parallel with the bristles.

19. The electric toothbrush as claimed in any one of the claims 2 to 18, characterised in
20 that the shaft and/or brush attachment coupled to the handle constitute integral parts of a rocker arm which is mounted inside the handle in such a way as to swivel approximately perpendicular to the axis, in particular about the axis.

20. The electric toothbrush as claimed in claim 19, characterised in that the electric motor
25 is coupled to means for generating vibrations or oscillations, said means acting on a cantilever of the rocker arm opposite the brush attachment.

21. The electric toothbrush as claimed in claim 20, characterised in that the means provided for generating vibrations or oscillations is an eccentric element mounted on the
30 motor shaft of the electric motor and bearing on the cantilever of the rocker arm.



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22. The electric toothbrush as claimed in any claim 20 or 21, characterised in that the cantilever is provided with a sliding shoe or a roller on which bears said eccentric element.

23. The electric toothbrush as claimed in claim 22, characterised in that said eccentric
5 element is provided in the form of a cylinder with one or more cams on which bears the cantilever by means of a roller or a sliding shoe.

24. The electric toothbrush as claimed in any one of the preceding claims, characterised in that an eccentric sleeve carrying a ball bearing or the like is mounted on the motor shaft.

10

25. The electric toothbrush as claimed in any one of the claims 22 or 23, characterised in that said eccentric element is provided in the form of an anti-friction bearing, in particular a ball bearing having an eccentric inner race mounted on the motor shaft.

15

26. The electric toothbrush as claimed in any one of the claims 20 to 23 or 25, characterised in that a spring element is provided, in particular a bending spring, a helical compression spring or the like, by means of which the cantilever of the rocker arm is urged in the direction of the motor shaft in particular against the eccentric element of the motor shaft.

20

27. The electric toothbrush as claimed in any one of claims 22 to 26, characterised in that the cantilever is lifted off the eccentric element on the motor shaft when a force applied to the bristles of the bristle head is exceeded.

25

28. The electric toothbrush as claimed in any one of claims 19 to 27, characterised in that the rocker arm is provided with a tube which extends in the direction of the brush attachment and in which the shaft is arranged, said tube extending from the handle by means of an elastic means, in particular an elastic diaphragm, an elastic bellows or the like.

30

29. The electric toothbrush as claimed in any one of the preceding claims 19 to 28,



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characterised in that the motor shaft of the electric motor and the shaft which is in particular part of the rocker arm assembly are connected with each other by way of a four-bar linkage.

30. The electric toothbrush as claimed in any one of claims 19 to 29, characterised in that
5 a frame is provided which supports the rocker arm and which is itself housed inside the handle.

31. The electric toothbrush as claimed in claim 30, characterised in that the electric motor is mounted on the frame.

10

32. The electric toothbrush as claimed in claims 30 or 31, characterised in that the frame is retained in the handle in elastic fashion.

15

33. The electric toothbrush as claimed in any one of claims 2 to 32, characterised in that the shaft is mounted in the handle so as to be not allowed to swivel with respect to the axis and is connected to the brush shaft by means of a balancing coupling.

20

34. The electric toothbrush as claimed in any one of the preceding claims, characterised in that one coupling member, in particular the tube of the handle, is mounted in the handle so as to be permitted to swivel with respect to the axis.

35. The electric toothbrush as claimed in any one of the preceding claims, characterised in that the shaft can be put in an oscillating or continuous rotary movement around the axis or in reciprocating stroke movements in the direction of the axis.

25 36. An electric toothbrush substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 31st day of May, 1999

BRAUN AKTIENGESELLSCHAFT

By Its Patent Attorneys

30 DAVIES COLLISON CAVE



Abstract of the Disclosure

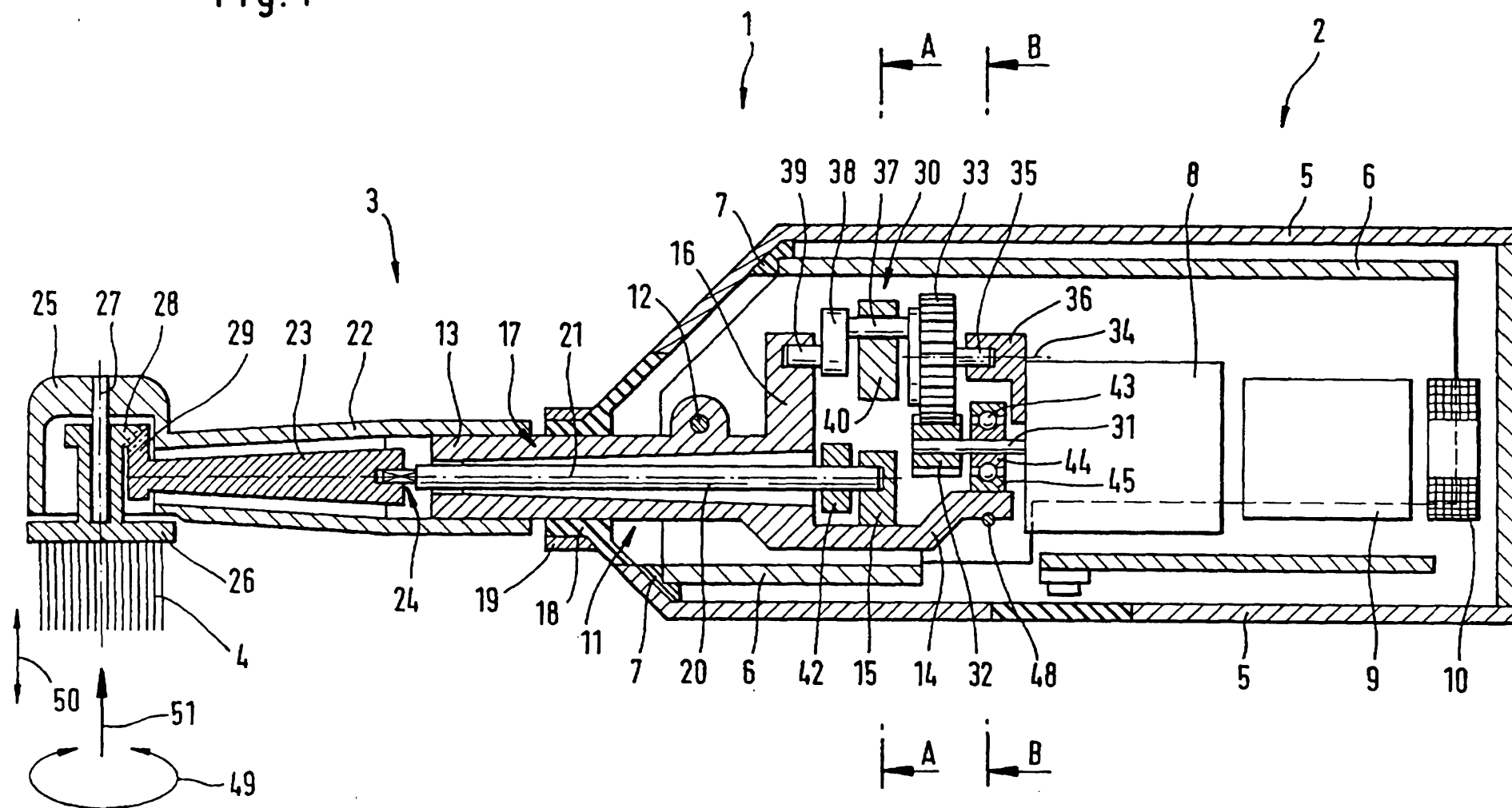
The invention is directed to an electric toothbrush (1) which incorporates a handle (2) and a brush attachment (3). The handle (2) houses an electric motor (8). Protruding from the handle (2) is a shaft (20) that is coupled to the electric motor (8). The brush attachment (3) can be mounted on the handle (2). The brush attachment (3) supports a bristle head (26) which can be coupled to the shaft (20) and from which protrude a multiplicity of bristles (4). In the operating mode, the bristle head (26) describes a rotary movement (49) and a stroke movement (50), with the frequency of the stroke movement (50) being higher, and preferably substantially higher, than the frequency of the rotary movement (49). The stroke movement (50) provides a poking action of the bristles (4) which serves to loosen plaque from dental surfaces. The rotary movement (49) serves to wipe away plaque loosened from the dental surfaces.

(FIG. 1)

04 Feb 98/BH.



Fig. 1



2 / 3

Fig. 2

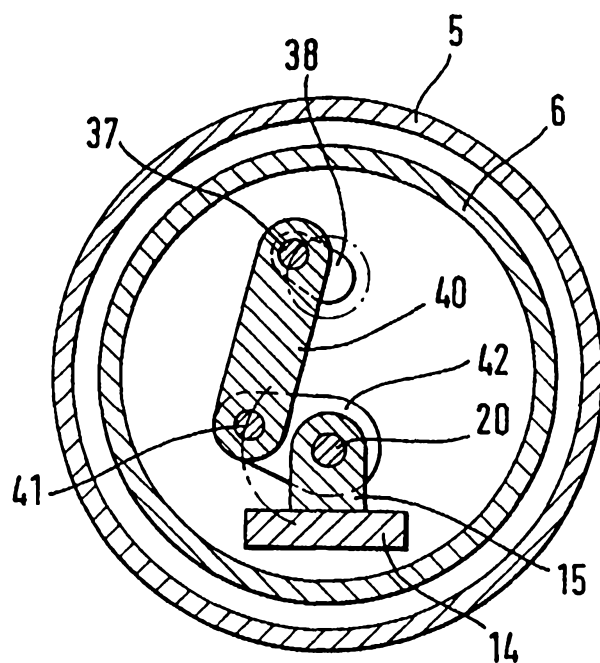


Fig. 3

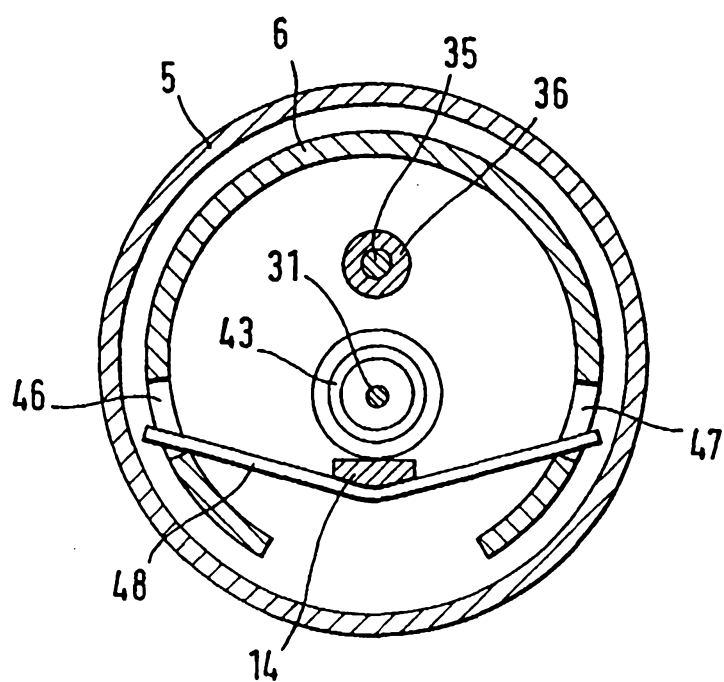


Fig. 4

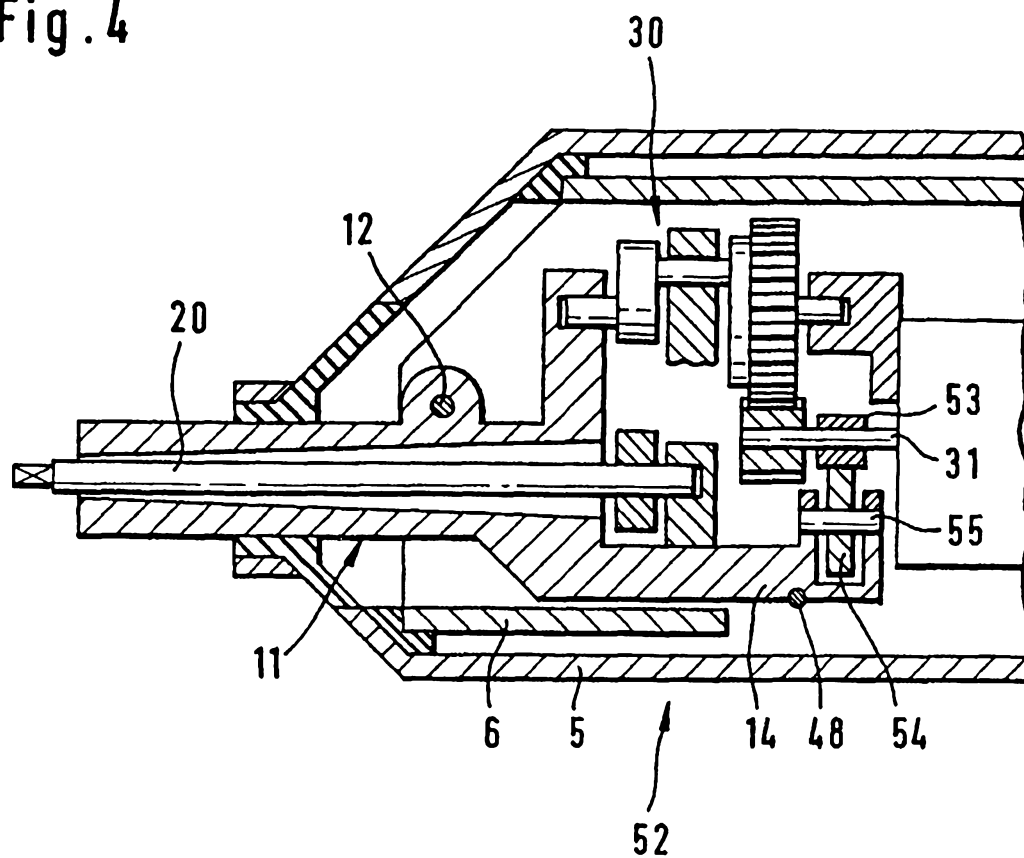


Fig. 5

