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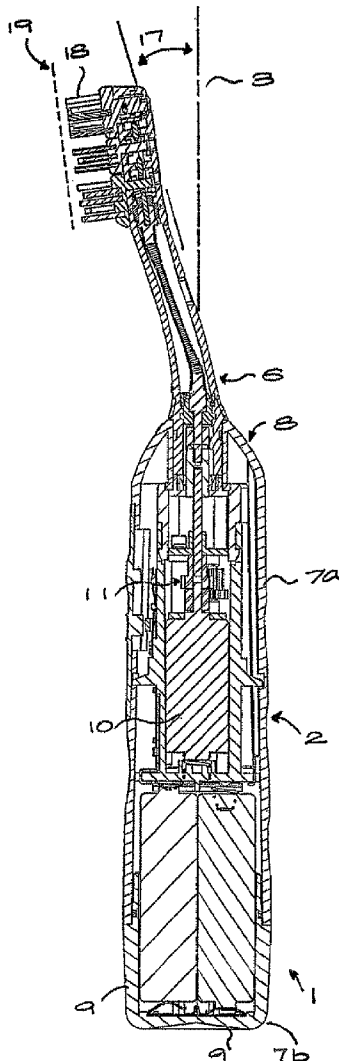
(19) **United States**(12) **Patent Application Publication**
Wang(10) **Pub. No.: US 2007/0294847 A1**(43) **Pub. Date: Dec. 27, 2007**(54) **ELECTRIC TOOTHBRUSH WITH SKEWED
NECK****Publication Classification**(75) Inventor: **Thomas Hai Wang**, Hong Kong
(CN)(51) **Int. Cl.**
A46B 13/02 (2006.01)(52) **U.S. Cl.** **15/22.2; 15/22.1**(57) **ABSTRACT**

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Kong (CN)(21) Appl. No.: **11/747,267**(22) Filed: **May 11, 2007**(30) **Foreign Application Priority Data**

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An elongate neck of a toothbrush extends askew to an elongate handle which encloses a rotary motor. At the end of the neck is a head to which brush blocks are mounted for movement relative to the head. The transmission includes a driving member and a driven member for transmitting torque from the motor, the driving member rotating about a driving member axis, and the driven member rotating about a driven member axis. A crankshaft mounted to the head converts rotation of the driven member to movement of a brush block, the driven member axis is skewed or offset relative to the driving member axis, and the driving member and the driven member are connected by a helical spring flexible coupling. One brush block rotates in an oscillating manner and a pair of brush blocks oscillate, in a linear manner, 180 degrees out of phase.



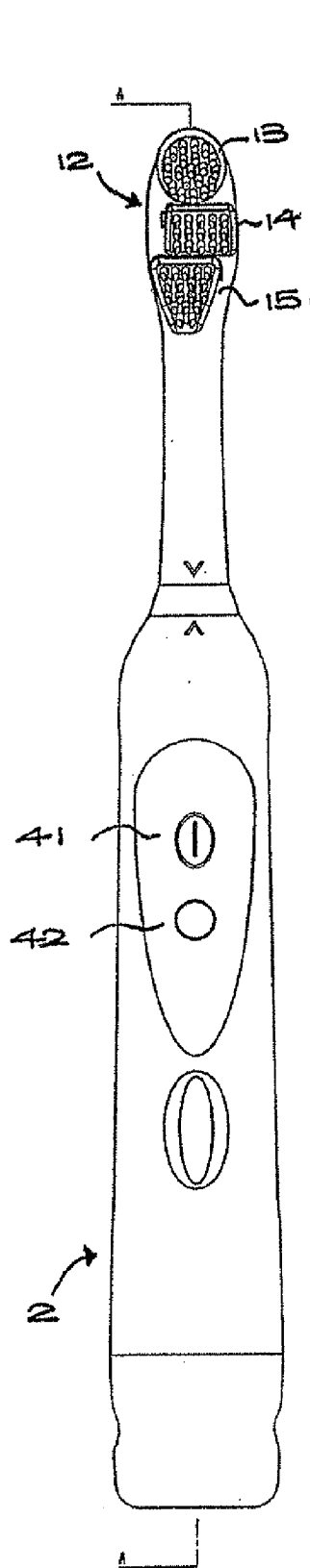


FIG 1.

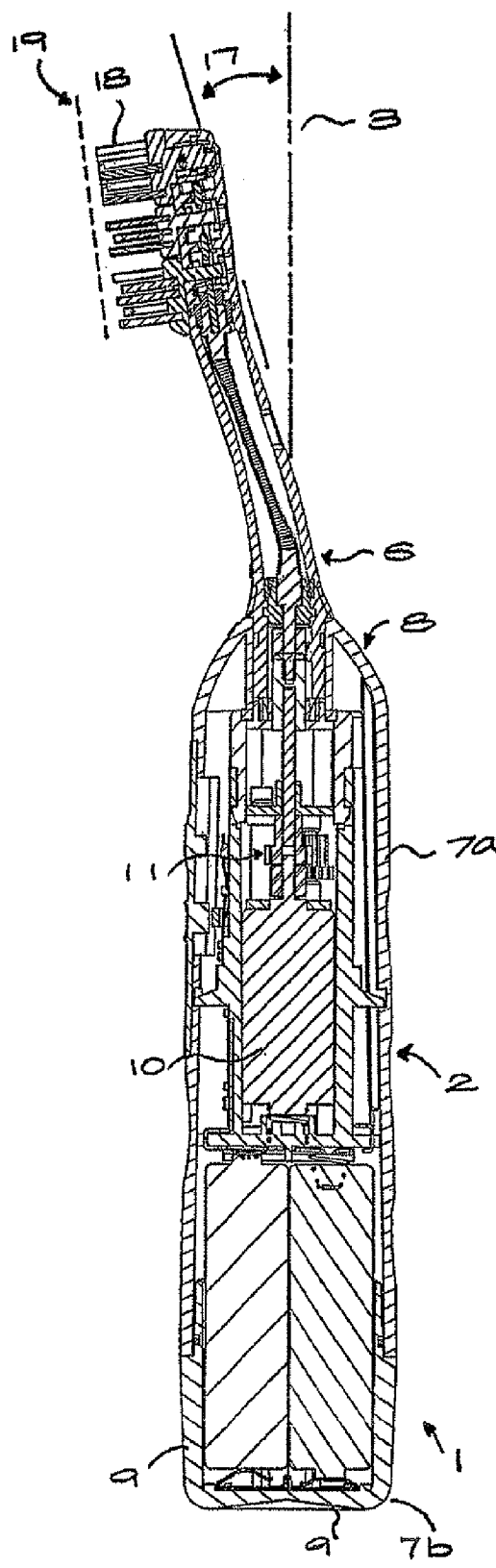


FIG 2.

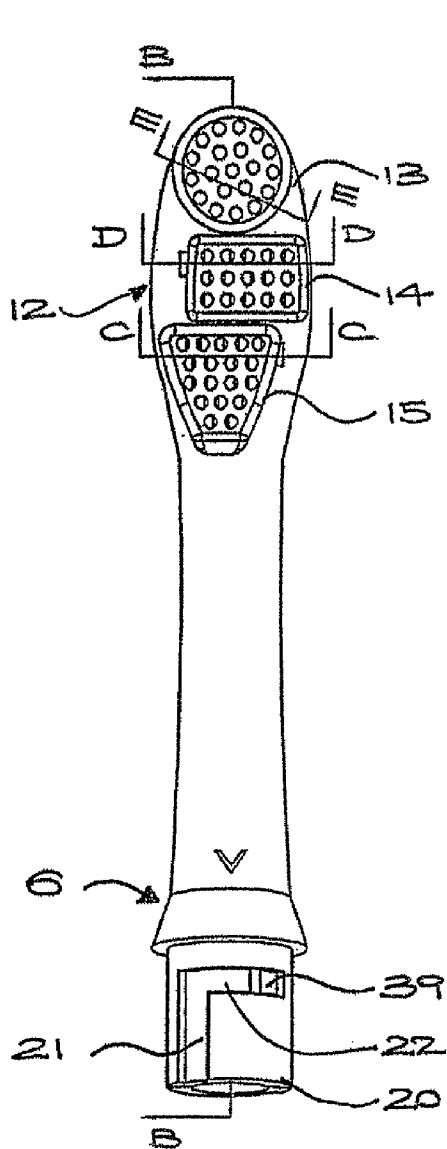


FIG 3.

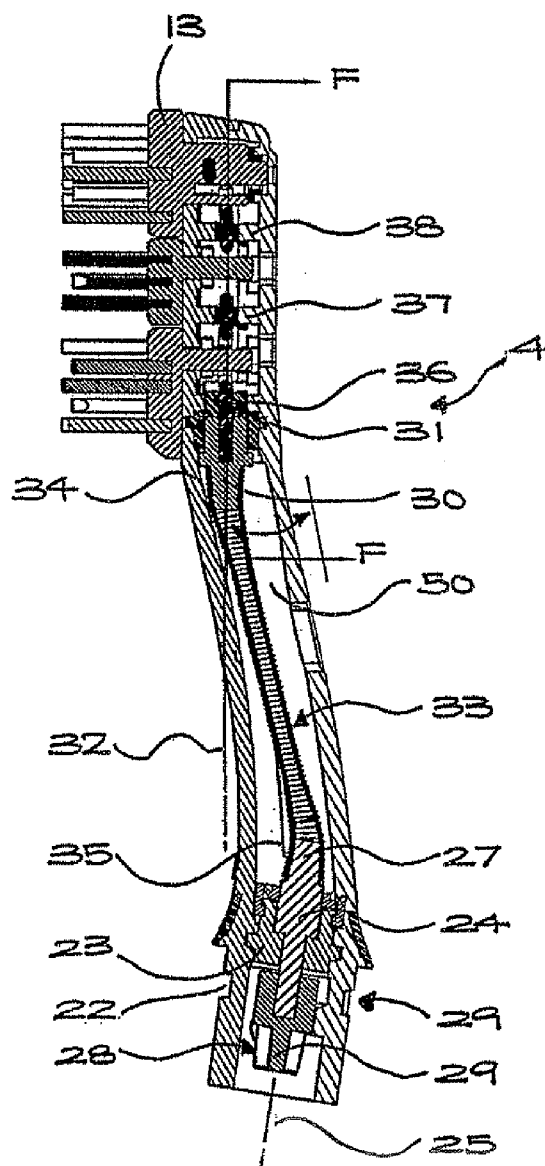


FIG 4.

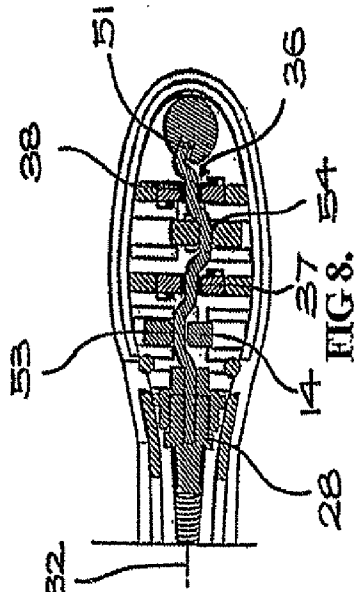


FIG. 8.

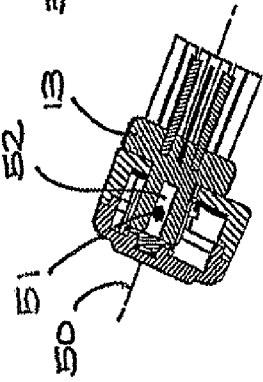


FIG. 7.

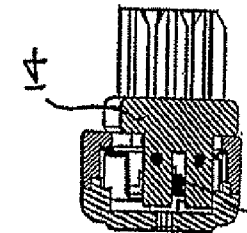


FIG. 6.

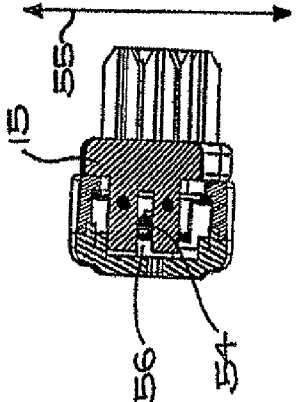


FIG. 5.

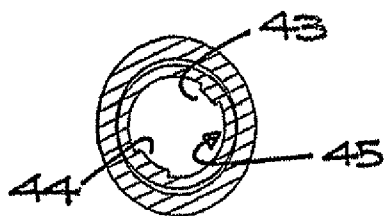


FIG 10.

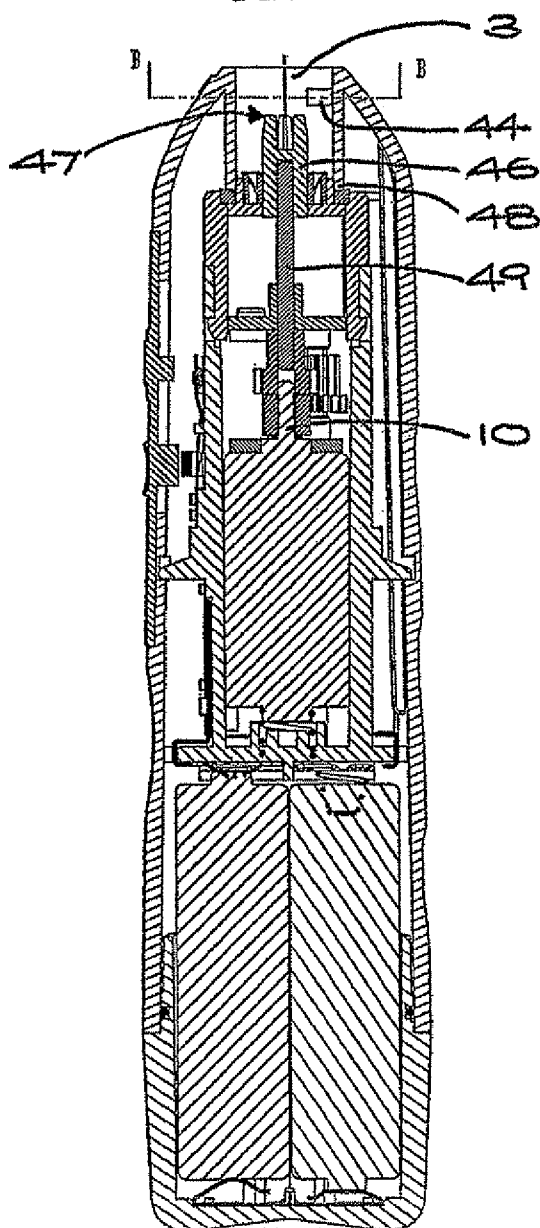


FIG 9.

ELECTRIC TOOTHBRUSH WITH SKEWED NECK

BACKGROUND OF THE INVENTION

[0001] The present invention relates to electric toothbrushes having an oscillating brush block with an elongate handle and neck, the neck being skewed relative to the handle. More particularly, the invention relates to electric toothbrushes wherein the transmission includes two rotating members with skewed axes of rotation to accommodate the skew between the handle and neck.

[0002] Some known electric toothbrushes have a brush block driven to oscillate by a rotating drive shaft. Typically the drive shaft is coaxial with a motor and gearbox and is elongated to extend through the neck of the toothbrush or replaceable brushing attachment. The handle is elongate, encloses the motor and gearbox, and the neck extends parallel to the handle. The transmission may have an eccentric that fits into a slot formed in the brush block to cause the oscillation. It would be advantageous however, for ergonomic reasons, that the neck be skewed relative to the handle, and doing so creates difficulties with a transmission of this type due to the angle through which the torque must be transmitted. While a bevel gear drive can be used to connect two members when their axes of rotation are skewed, this arrangement is relatively costly to manufacture and so is particularly disadvantageous when this part of the transmission is mounted in a replaceable brushing attachment.

[0003] It is an object of the present invention to provide an improved electric toothbrush of the type having an elongate handle and neck skewed relative to one another, the handle and neck enclosing a transmission connecting a rotary motor to an oscillating brush block wherein the transmission includes two rotating members with skewed or offset axes of rotation to transmit torque between the skewed handle and neck.

[0004] It is a further object of the present invention to provide an improved replaceable brushing attachment having an elongate neck adapted to extend askew to a handle to which it may be releasably connected.

DISCLOSURE OF THE INVENTION

[0005] According to one aspect of the invention there is provided an electric toothbrush comprising:

an elongate handle enclosing a rotary motor;
an elongate neck extending askew to the handle and having a head at a distal end thereof;

at least one brush block mounted to the head for movement relative thereto;

a transmission including a driving member connected to a driven member for transmitting torque from the motor, the driving member rotating about a driving member axis, the driven member rotating about a driven member axis;
a conversion mechanism mounted to the head and adapted for converting rotation of the driven member to movement of the brush block, wherein

the driven member axis is skewed or offset relative to the driving member axis, and the driving member and driven member are connected by a helical spring flexible coupling.

[0006] The helical spring flexible coupling is able to transmit the torque while accommodating skew (i.e. angular misalignment) and/or offset (i.e. parallel misalignment)

between the drive and driving member axes, and thus allows a toothbrush of this type to be manufactured more cost effectively. The coupling may possibly also accommodate a degree of end float or axial misalignment between the driving and driven members.

[0007] The neck is releasably attachable to the handle, having means at a proximal end thereof for fastening to the handle. Preferably the fastening means is a bayonet coupling, allowing the neck to be fastened by a push-turn action.

[0008] Preferably the driving member is mounted at the proximal end and the driven member mounted in the head, the helical spring flexible coupling being elongated to extend within the neck between the driving and driven members.

[0009] The helical spring flexible coupling preferably has a substantially cylindrical body with outwardly tapered frusto-conical ends adapted to receive cooperating tapered portions of the driving and driven members in a push fit.

[0010] The transmission preferably further includes a gearbox for increasing the torque applied to the driving member and reducing its speed of rotation, the axes of the motor, gearbox and driving member being coaxial with a central longitudinal axis of the handle.

[0011] In the preferred embodiment three brush blocks are mounted to the head for separate oscillatory movement relative thereto, the conversion mechanism comprising a crankshaft, the brush blocks including a pair of sliding brush blocks mounted for linear sliding movement relative to the head and a rotary brush block mounted to rotate relative to the head.

[0012] The crankshaft is preferably connected to the driven member with which it is connected coaxially, each sliding brush block being mounted for sliding movement substantially perpendicular to the driven member axis, each rotary brush block being mounted for rotation about a respective rotary block axis substantially perpendicular to the sliding block axis, the crankshaft having an eccentric throw for engaging each brush block.

[0013] Each sliding block throw is received in an aperture in the sliding block which extends substantially parallel to the crankshaft axis, and each rotary block throw is received in a slot in the rotary block which extends substantially parallel to its respective rotary block axis.

[0014] In another aspect the invention provides a replaceable brushing attachment comprising:

an elongate hollow neck having a proximal end with means for releasably fastening to a handle enclosing a rotary motor, the neck further having a head on a distal end thereof;

at least one brush mounted to the head for movement relative thereto;

a transmission enclosed substantially within the neck, the transmission including a driving member joined by a connector to a driven member for transmitting torque from the motor, the driving member rotating about a driving member axis, the driven member rotating about a driven member axis;

a conversion mechanism mounted to the head and adapted for converting rotation of the driven member to movement of the brush, wherein

the driven member axis is skewed or offset relative to the driving member axis, and the connector comprises a helical spring flexible coupling.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

[0016] FIG. 1 is a plan view of a toothbrush according to the invention,

[0017] FIG. 2 is transverse cross-section (along line AA) of the toothbrush of FIG. 1,

[0018] FIG. 3 is a plan view of the neck or replaceable brushing attachment of the toothbrush of FIG. 1 shown separated from the handle,

[0019] FIG. 4 is transverse cross-section (along line AA) of the neck or replaceable brushing attachment of FIG. 3,

[0020] FIG. 5 is cross-section (along line CC) of FIG. 4,

[0021] FIG. 6 is transverse cross-section (along line DD) of FIG. 4,

[0022] FIG. 7 is transverse cross-section (along line EE) of FIG. 4,

[0023] FIG. 8 is transverse cross-section (along line FF) of FIG. 4, and

[0024] FIG. 9 is transverse cross-section of the handle of the toothbrush of FIG. 1 shown separated from the neck or replaceable brushing attachment, and

[0025] FIG. 10 is transverse cross-section (along line BB) of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] Referring to FIGS. 1 and 2, the electric toothbrush 1 includes a handle 2 having a longitudinal axis 3 and an elongate neck 4. The handle 2 includes hollow casing part 7a at one end of which is fixed casing part 7b and to which the neck 4 is fixed at the opposing tapered end 8. Enclosed in the handle 2 are two batteries 9, rotary motor 10 and gearbox 11, the axes of both the motor 10 and gearbox 11 being coaxial with a central longitudinal axis 3. At a distal end 5 of the neck 4 is a head 12 to which brush blocks 13, 14 and 15 are mounted. The brush blocks 13, 14 and 15 have bristles 18, the ends of which define a tooth-contacting plane (indicated generally by the dashed line 19). The neck 4 is skewed relative to the handle, the longitudinal axis of the neck being curved, relative to the axis 3, in a plane substantially perpendicular to the tooth-contacting plane 19, smoothly curving between the proximal end 6 and the distal end 5 through an angle 17 of 20°.

[0027] As best seen from FIGS. 3 and 4, the neck 4 is detachable from the handle to provide a replaceable brushing attachment. The means for fastening the handle 2 and neck 4 is a bayonet coupling. At the proximal end 6 is a cylindrical portion 20 in which two L-shaped slots are formed, each having an axial portion 21 and circumferential portion 22 for cooperating with a nub 43, 44 provided on the handle 2 (as described below). At the end of each circumferential portion 22 is a radially extending protrusion 39.

[0028] Received in a journal 23 mounted inside the proximal end 6 is a driving member 23 which rotates about a driving member axis 25, which is coaxial with the central longitudinal axis 3 when the handle and neck are assembled. The inner end 27 of the driving member 23 is tapered and the

opposing end is attached to a first part 28 of a connector, the first part having an outer end 29 which is cross-shaped in transverse section.

[0029] The driven member 30 is fixed inside the head 12 and rotates about a driven member axis 32 both skewed and offset relative to the driving member axis 25.

[0030] The helical spring flexible coupling 33 is elongated to extend within the neck 4 to provide a torsional coupling between the driving and driven members 24, 30. The flexible coupling 33 is relatively stiff torsionally, being closely wound with adjacent coils abutting. The helical spring flexible coupling 33 has a cylindrical body with frusto-conical ends 34, 35 opening outwardly to receive the tapered ends 27, 30 of the driving and driven members in a push fit.

[0031] The conversion mechanism for converting rotation of the driven member 30 to movement of the brush blocks 13, 14, 15 includes a crankshaft 36 fixed to the driven member 30. The crankshaft 36 is mounted by coaxial journals 31, 37 and 38 spaced at intermediate positions along its length to rotate about the driven member axis 32. The axis 32 of the driven member and crankshaft 36 is inclined at an angle 50 of approximately 10° relative to the central longitudinal axis of the flexible coupling 33.

[0032] Referring to FIGS. 5-8, the rotating brush block 13 is mounted to rotate about an axis 50 perpendicular to the crankshaft axis 32. A rotary block eccentric throw 51 formed on the end of crankshaft 36 is received in a slot 52 parallel to axis 50 to oscillate the block 13.

[0033] Both the sliding brush blocks 14, 15 are received in the head to reciprocate transversely in direction 55. The throw 53 nearest the driven member 28 and the throw 54 are both circular in cross-section and received in an aperture 56 which extends perpendicular to the crankshaft axis 32 and to direction 55. A throw 54 for driving the sliding block 14 is 180 degrees out of phase with the throw 53 for driving the block 15, oscillating the blocks in opposing directions.

[0034] At the end of the handle 2 is a recess with cylindrical walls 45 for receiving the end portion 20. Opposing nubs 43, 44 project inwardly from the walls 45. In use, when the handle is grasped with the user's thumb projecting toward the head 12 and resting over the switches 41, 42 for controlling the motor 10, then the neck 4 is skewed for best ergonomic positioning. To ensure the neck 4 cannot be angularly misaligned when fixed to the handle 2, the nub 43 is longer circumferentially than the nub 44, each being received in an axial portion 21 which is correspondingly wider. The nubs 43, 44 ride over the respective protrusions 39 which thereby provide a detent action, holding the head in position.

[0035] At the inner end of the recess is a second part 46 of a connector, for cooperating with the first part 28 having an outer end 47 having a cross-shaped recess to receive the end 29. The second part 46 is fixed in a bearing 48 to rotate with the gearbox output shaft 49 with which it is coaxially mounted, together with the motor 10.

[0036] Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

1. An electric toothbrush comprising:
an elongate handle enclosing a rotary motor;
an elongate neck extending askew to the handle and having a head at a distal end of the neck;

- at least one brush block mounted to the head for movement relative to the head;
 - a transmission including a driving member connected to a driven member for transmitting torque from the motor, the driving member rotating about a driving member axis, the driven member rotating about a driven member axis;
 - a helical spring flexible coupling connecting the driving member to the driven member; and
 - a conversion mechanism mounted to the head for converting rotation of the driven member into movement of the brush block, wherein the driven member axis is skewed or offset relative to the driving member axis.
2. The toothbrush of claim 1 including fastening means at a proximal end of the neck for releasably fastening the neck to the handle.
 3. The toothbrush of claim 2 wherein the fastening means is a bayonet coupling fastening the neck to the handle by a push-turn action.
 4. The toothbrush of claim 1 wherein the driving member is mounted at a proximal end, the driven member is mounted in the head, and the helical spring flexible coupling is elongated to extend within the neck between the driving and driven members.
 5. The toothbrush of claim 4 wherein the helical spring flexible coupling has a substantially cylindrical body with outwardly tapered frusto-conical ends for receiving cooperating tapered portions of the driving and driven members in a push fit.
 6. The toothbrush of claim 5 wherein the transmission further includes a gearbox for increasing the torque applied to the driving member and reducing speed of rotation of the driving member, axes of the motor, the gearbox, and the driving member being coaxial with a central longitudinal axis of the handle.
 7. The toothbrush of claim 6 wherein the conversion mechanism comprises a crankshaft.
 8. The toothbrush of claim 7 including at least one sliding brush block mounted for linear sliding movement relative to the head and at least one rotary brush block mounted to rotate relative to the head.
 9. The toothbrush of claim 8 including three brush blocks mounted to the head for separate oscillatory movement relative to the head, the brush blocks including a pair of sliding brush blocks and one rotary brush block.
 10. The toothbrush of claim 9 wherein
 - the crankshaft is connected to the driven member coaxially,
 - each sliding brush block is mounted for sliding movement substantially perpendicular to the driven member axis,
 - each rotary brush block is mounted for rotation about a respective rotary brush block axis substantially perpendicular to the sliding block axis, and
 - the crankshaft has an eccentric throw for engaging each sliding and rotary brush block.
 11. The toothbrush of claim 10 wherein each sliding block throw is received in an aperture in a respective sliding brush block, the aperture extending substantially parallel to an axis of the crankshafts, and each rotary brush block throw is received in a slot in the rotary brush block, the slot extending substantially parallel to a rotary brush block axis.
 12. The toothbrush of claim 11 wherein the neck is curved.

13. A replaceable brushing attachment comprising:
 - an elongate hollow neck having a proximal end with means for releasably fastening to a handle enclosing a rotary motor, the neck further having a head on a distal end of the neck;
 - at least one brush mounted to the head for movement relative to the head;
 - a transmission enclosed substantially within the neck, the transmission including a driving member joined by a connector to a driven member for transmitting torque from the motor, the driving member rotating about a driving member axis, the driven member rotating about a driven member axis;
 - a conversion mechanism mounted to the head for converting rotation of the driven member into movement of the brush, wherein
 - the driven member axis is skewed or offset relative to the driving member axis, and
 - the connector comprises a helical spring flexible coupling.
14. The replaceable brushing attachment of claim 13 including fastening means at a proximal end of the neck for releasably fastening to the handle.
15. The replaceable brushing attachment of claim 14 wherein the fastening means is a bayonet coupling, fastening the neck to be the handle by a push-turn action.
16. The replaceable brushing attachment of claim 14 wherein the driving member is mounted at a proximal end, the driven member is mounted in the head, and the helical spring flexible coupling is elongated to extend within the neck between the driving and driven members.
17. The replaceable brushing attachment of claim 16 wherein the helical spring flexible coupling has a substantially cylindrical body with outwardly tapered frusto-conical ends for receiving cooperating tapered portions of the driving and driven members in a push fit.
18. The replaceable brushing attachment of claim 17 wherein the conversion mechanism comprises a crankshaft.
19. The replaceable brushing attachment of claim 18 including at least one sliding brush block mounted for linear sliding movement relative to the head and at least one rotary brush block mounted to rotate relative to the head.
20. The replaceable brushing attachment of claim 19 including three brush blocks mounted to the head for separate oscillatory movement relative to the head, the brush blocks including a pair of sliding brush blocks and a one rotary brush block.
21. The replaceable brushing attachment of claim 20 wherein
 - the crankshaft is connected to the driven member coaxially,
 - each sliding brush block is mounted for sliding movement substantially perpendicular to the driven member axis,
 - each rotary brush block is mounted for rotation about a respective rotary brush block axis substantially perpendicular to the sliding block axis, and
 - the crankshaft has an eccentric throw for engaging each sliding and rotary brush block.
22. The replaceable brushing attachment of claim 21 wherein each sliding block throw is received in an aperture in a respective sliding brush block, the aperture extending

substantially parallel to an axis of the crankshafts, and each rotary brush block throw is received in a slot in the rotary brush block, the slot extending substantially parallel to a rotary brush block axis.

23. The replaceable brushing attachment of claim **22** wherein the neck is curved.

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