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2,657,321

POWER-DRIVEN TOOTHBRUSH

Filed Nov. 9, 1950

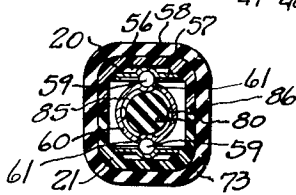
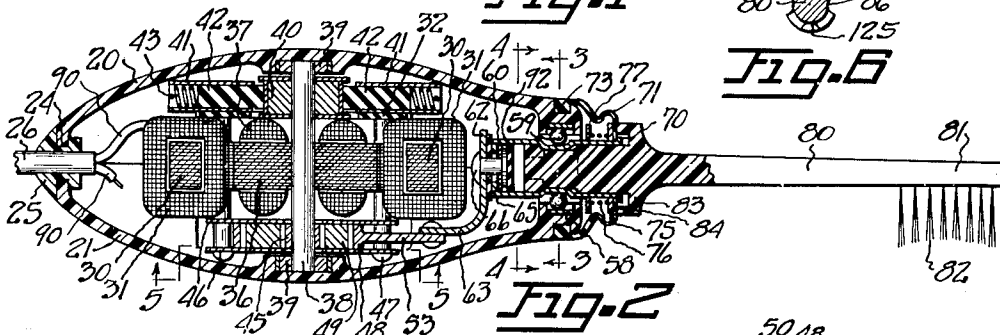
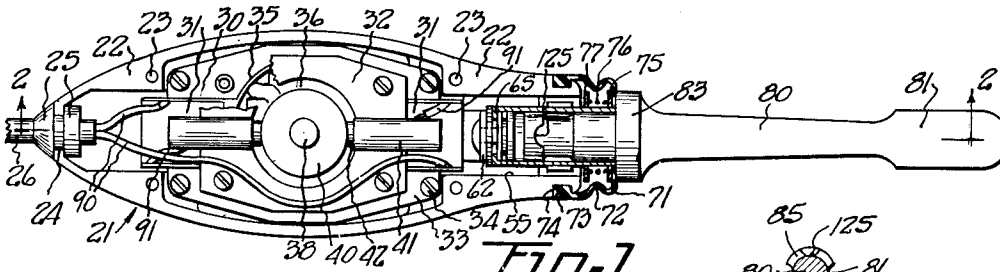


Fig. 3

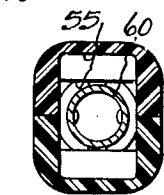


Fig. 4

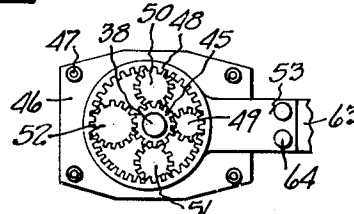


Fig. 5

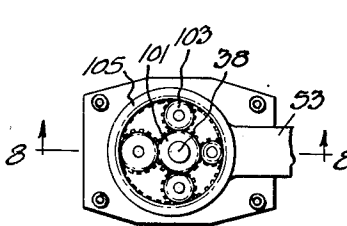


Fig. 7

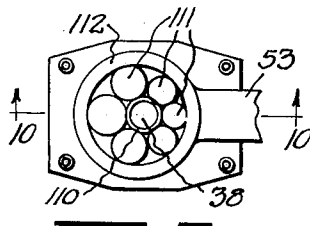


Fig. 9

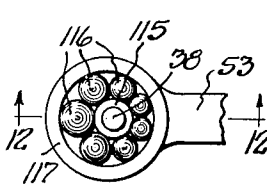


Fig. 11

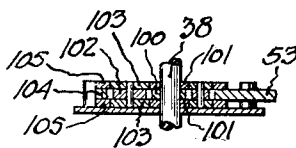


Fig. 8

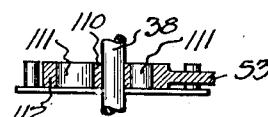


Fig. 10

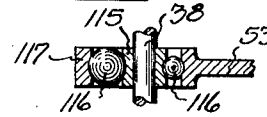


Fig. 12

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POWER-DRIVEN TOOTHBRUSH

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13 Claims. (Cl. 310—50)

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This invention relates to improvements in power driven tooth brushes, and more particularly to a tooth brush of the character illustrated in my co-pending application, Serial No. 170,195, filed June 24, 1950.

The tooth brush is particularly intended for use in the treatment of unhealthful conditions of the gum tissues by massaging the gum tissues by oscillation or movement of small amplitude in which the side of the bristles rather than the tips of the bristles of the brush move in contact with the gum tissues. The treatment of unhealthful gum tissues in this manner is commonly referred to as the Charter technique, which technique is recognized as standard treatment in this field and entails an orbital path of flexing movement wherein the dimensions of the path are small, that is, in an amplitude not substantially greater than one-eighth of an inch.

In conducting the Charter treatment by a power operated device, it has been found that, even though the brush bristles are pressed lightly against the gum tissues, the pressure develops a load which the ordinary small vibrator or motor is not adapted to stand. At the same time it is desirable to maintain the parts in compact form and preferably provide a motor or power element which can be held in the hand and to which a brush can be attached for operation in an orbital movement.

It is therefore the primary object of this invention to provide a device of adequate power for its purpose which is small and compact in size and in which friction of the operating parts has been reduced to a minimum.

A further object is to provide a device of this character employing a planetary type of speed reducing element which provides an oscillatory or eccentric movement of small amplitude with minimum friction loss.

A further object is to provide a device of this character to which the shank of a brush may be detachably connected for use and in which a seal is provided against entry of moisture or saliva at the point of connection of the brush with the drive element, which seal serves also to assist in holding the brush in position.

A further object is to provide a device of this character wherein a brush shank is detachably mounted upon a motor housing for oscillatory movement by means of a connecting mechanism utilizing ball bearings to reduce friction between the parts and to absorb torsional moments.

A further object is to provide a device of this character which is compact, of light weight, efficient, and which will easily be grasped and held in the hand.

A further object is to provide a device of this character wherein means are provided to translate the operation of an electric motor into oscil-

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latory movement and to reduce the number of oscillations of output per unit time to a small fraction of the number of revolutions of the motor in the same unit of time.

A further object is to provide a device of the character which is effective to seal the tooth brush shank and the shaft which mounts said shank with one unit, including a resilient part which applies pressure to hold a detachable connection between the brush shank and the mounting tube in assembled operating condition.

A further object of the invention is to provide a device of this character of symmetrical construction wherein the center of mass and the center of the oscillation producing eccentric means occur at substantially the same point.

A further object is to provide a device of this character wherein all parts are effectively electrically insulated.

Other objects will be apparent from the following specification.

In the drawing:

Fig. 1 is a top plan view of the brush with part of the casing of the device removed and with parts of the device broken away.

Fig. 2 is a longitudinal axial sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a longitudinal sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a fragmentary sectional view taken on line 5—5 of Fig. 2.

Fig. 6 is a cross-sectional view of the shank of the brush taken on line 3—3 of Fig. 2.

Fig. 7 is a view similar to Fig. 5 but illustrating a modified embodiment of the invention.

Fig. 8 is a sectional view taken on line 8—8 of Fig. 7.

Fig. 9 is a view similar to Fig. 5, illustrating another embodiment of the invention.

Fig. 10 is a sectional view taken on line 10—10 of Fig. 9.

Fig. 11 is a view similar to Fig. 5, but illustrating a modified embodiment of the invention.

Fig. 12 is a sectional view taken on line 12—12 of Fig. 11.

Referring to the drawing which illustrates the preferred embodiment of the invention, the numerals 20 and 21 designate two registering parts of a casing or housing. The housing parts are adapted to be secured together to form a generally elongated hollow housing. The casing parts preferably meet at a longitudinal substantially central parting plane and are suitably ribbed or provided with bosses 22 in which apertures 23 may be formed to accommodate securing screws or the like (not shown) for connecting the housing parts together. The housing or casing will preferably be of a size and shape to

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fit conveniently within the palm of the hand of the user and will be preferably molded from plastic material, hollow rubber or other suitable material preferably of dielectric or non-conductive nature. At one end of the housing the parts thereof will be shaped to provide a restricted opening 24 adapted to receive a grommet or fitting 25 which encircles an insulated electric lead wire 26 to provide a seal at the point where the wire 26 enters the casing.

The housing 20, 21 mounts and encloses an electric motor which may be of any type found suitable. A series wound A. C.-D. C. brush type motor is preferred. This motor has a laminated frame or field laminations unit, including a pair of end portions 30 each encircled by a coil 31. The motor will be provided with suitable frame portions 33 and screws 34 by which it is secured to the housing, preferably to one part of the housing so as to permit the separation of the housing parts without disconnecting the motor from the housing part to which it is secured, in the manner well understood in the art. Plate 32 is anchored to the motor frame or field lamination unit at spaced points to constitute a brush holder mounting plate and is spaced inwardly from and has clearance with the adjacent portion 20 of the housing.

The laminated motor frame has a substantially central circular opening 35 formed therein to receive a laminated motor armature 36 whose axis is concentric with the opening 35 and perpendicular to the parting plane between the housing parts 20, 21. The motor armature is provided with the usual coils 37 wound thereon. An axial shaft 38 projects from both sides of the armature 36 through the openings in the retainers or plates 32 and is journaled at its opposite ends in bearings 39 of any suitable type carried by the housing parts 20, 21.

One projecting end portion of the armature shaft 38 carries a commutator 40 which is positioned in the space between the armature and the adjacent or confronting surfaces of the housing parts, such as the part 20 illustrated in Fig. 2. The adjacent plate 32 of the motor mounts brush holders 41, such as tubular parts whose axes extend substantially perpendicular to the axis of the commutator 40 and the shaft 38 and receive and position brush members 42 which are spring pressed by the springs 43 within the outer parts of the tubular members 41 so that the brushes 42 are pressed against the commutator 40.

At the sides of the motor opposite the arrangement of the commutator 40 and brushes 42 and interposed between the motor and the housing part 21, is positioned a unit which serves the combined purposes of producing oscillatory or eccentric movement and reducing the speed of oscillation compared to the speed of rotation of the motor. The unit will preferably be of the character best illustrated in Fig. 5, although it will be understood that this unit may be also of any of the types illustrated in Figs. 7 and 8, or in Figs. 9 and 10, or in Figs. 11 and 12.

Referring to the embodiment illustrated in Fig. 5, the portion of the motor shaft 33 which projects from the motor frame fixedly mounts a pinion 45 which is positioned between a pair of substantially parallel retaining plates 46 secured together at spaced points by the screws or other securing means 47 and with spacers interposed between the motor frame and the retaining plates 46. The annular member or ring gear 48 having

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internal gear teeth is interposed between the plates 46 and encircles the pinion 45 with substantial clearance. A plurality of small gears 49, 50, 51 and 52 are arranged in spaced relation between the plates 46 within and meshing with the ring gear 48 and also each meshing with the pinion 45. The gears 49-52 are spaced from one another and, where four of them are employed as here illustrated, one, such as 49, will be small, and another, such as 52, will be large, and the two remaining gears 50, 51 will be of a size intermediate the size of the gears 49 and 52. It will be apparent that by this arrangement, the plates 46 confine the parts and absorb side thrust, and that rotation of the shaft 38 of the motor will produce an oscillatory bodily movement of the ring gear 48 in an orbital path whose speed is much reduced compared to the speed at which the motor shaft 38 rotates. The ring gear 48 has a rigid arm or projection 53 extending therefrom toward one end of the housing but terminating below and adjacent to one of the motor and frame parts 30, as best illustrated in Fig. 2. The pinion 45 and each of the gears 48, 49, 50, 51 and 52 will preferably be of the self-lubricating type although they may be ordinary metal parts or may be formed from fiber material or any other material found suitable.

The housing of the device, at the end thereof opposite that through which the electric conductor or lead 26 extends, is provided with a longitudinal passage 55, here shown as of substantially rectangular configuration, as best seen in Figs. 3 and 4. Within the passage 55 at its front end and at opposite sides thereof, are formed opposed recesses 56 which serve to mount metal plates 57, each preferably having a socket or race 58 therein adapted to receive and mount a ball or sphere 59. As best seen in Fig. 2, the sockets 58 are semi-cylindrical and are of a length greater than the diameter of the balls 59 so as to accommodate a limited extent of rolling movement of the balls therein in a longitudinal direction with respect to the length of the housing 20, 21. An elongated metal sleeve or tube 60 is positioned within the passage 55 with one end portion projecting outwardly from the end of the housing 20, 21, and the other projecting inwardly toward the motor with respect to the balls 59. The tube 60 is provided with a pair of longitudinal inwardly offset races 61 into which the balls 59 fit. It will be understood, as best seen in Figs. 2 and 3, that the tube 60 has clearance with the housing parts, and this clearance space is spanned only by the two balls 59. Hence the tube 60 is free to oscillate and also to move longitudinally as determined by the limit of movement of the balls 59 in their elongated receiving races 58 and 61. The inner end of the tube 60 is fixedly secured to one end portion 62 of a rigid bracket, said end portion 62 extending substantially transversely of and within the housing 20, 21 adjacent one end of the motor and being offset laterally to terminate in a portion 63 bent around the end of the motor and adapted to be riveted or otherwise fixedly secured by members 64 to the projection 53 of the ring gear 48. Any suitable means may be employed to interconnected the parts 60 and 62, and, as best illustrated in Fig. 2, the tube 60 is inwardly flanged at 65 and a rivet or other securing member 66 passes through the bracket 62 and enters the annular flange 65 with its head bearing against said flange. Rubber or fiber laminations or gaskets may be interposed be-

tween the parts for electrical insulation and noise reducing purposes.

The outer end of the tube 60 is preferably provided with an out-turned annular flange 70, and a skirt member 71, preferably formed of rubber or other resilient material and having a circumferential fold 72 formed therein, encircles the projecting end of the tube 60. The skirt 71 preferably has an integral annular ring 73 projecting inwardly at its rear end and adapted to seat within the groove 74 formed in the outer surface of the housing parts 20, 21 as best illustrated in Figs. 1 and 2. Within the skirt is positioned a flat annular disk member 75 slidable axially upon the sleeve 60 and pressed upon by a coil spring 76 which bears at one end upon an abutment member 77 fixedly carried by the sleeve 60. In the normal arrangement of the parts, the spring 76 presses outwardly upon the ring 75 to press the front margin of the skirt 71 against the flange 70 of the sleeve 60.

A brush, such as a tooth brush, is adapted to be detachably mounted upon the device, said brush having the usual shank portion 80 terminating in a head 81 carrying brush bristles 82. Intermediate its ends the shank 80 is provided with a lateral enlargement 83, preferably including a circumferential flange part 84 directed rearwardly and of substantially ring form to fit around the flange 70 at the outer end of the tube 60 and to press the outer end of the skirt 71 flat against the ring or plate 75. The shank 80 has a circumferential groove 85 formed therein spaced from its inner end and from the enlargement 83, 84 a distance to coincide with the sockets 61 formed in the tube 60. As best illustrated in Fig. 3, the sockets 61 fit into said groove 85 but the remaining portions of the circumference of the tube at that part of its length have clearance with the shank. A pair of longitudinal groove portions 86 are formed in the brush shank to extend from the circumferential groove 85 to the inner end thereof, and these grooves accommodate the insertion of the portion of the brush shank between the circumferential groove 85 and the inner end of the brush past the tube inset socket 61. The arrangement compares to a bayonet slot arrangement, it being understood that after the longitudinal insertion movement of the brush shank has been completed, the brush shank will be turned at an angle so as to disalign the grooves 86 from the tube sockets 61 and thereby prevent longitudinal play of the parts until they are again brought into alignment. The proportions of the parts are such that the flange 84 will press the outer end of the skirt 71 and the plate 75 inwardly against the spring 76 so that the shank is placed under spring tension to hold the tube sockets 61 in the recesses or indentations 125 of the shank and thus prevent accidental rotation or movement thereof to its releasing position. At the same time, application and removal of the brush can be accomplished easily.

Leads 90 from the electric line or conduit 26 extend to the coils 31, and the coils 31 in turn are connected in series with the motor brushes 42, the commutator 40 and the armature coils 37 by means of electric leads 91. Suitable insulation plate 32 is interposed between the brush carriers and the motor frame. It will be understood that the arrangement is such that the armature is series connected with the field windings 31. This construction is well known in the art and produces a compact and strong motor which will run freely without danger of overheating.

It will be apparent that this tooth brush is convenient for use, compact, and can be light in weight and is well balanced. It will also be noticed that the center of the orbital or oscillatory movement coincides with the center of the motor for purposes of balance and the avoidance of vibration. Balance further is facilitated by the positioning of the motor frame 30 substantially in the parting plane and substantially balanced with reference to the parting plane of the housing 20, 21. The position of the brushes 42 and commutator 40 on one side of the motor, and of the oscillation translating mechanism, as illustrated in Fig. 5, on the opposite side of the motor, provides for lateral balance of the weight of the parts. The motor itself can be made very strong and compact. Attention further is directed to the fact that friction is reduced to a minimum by the liberal use of bearings and the use of parts which will perform more than one function. In other words, wherever possible rolling members are utilized to reduce friction.

The planetary system of power reduction provides the necessary small amplitude of oscillation in an effective manner providing minimum friction. Also minimum space is required and the size of the casing can be held to a minimum because of the character, the construction and the arrangement of this mechanism.

It will be observed that the skirt 71 forms a seal against saliva or moisture and insures that there will be no danger of entry of such moisture in the use of the device either around the tube 60 or interiorly of the tube 60. In the latter connection, observe that an electrical insulator and seal barrier 92 may be provided in the tube inwardly of the securing rivet 66 for interior sealing purposes so that, if the device is left without a brush and should be subjected to moisture, such moisture cannot enter the interior of the housing, being barred by said barrier 92. It will be understood, of course, that in cases where the brush shank is not mounted in the tube 60, the spring 76 and plate 75 will press the skirt 71 against the tube flange 70 so that no moisture under such circumstances can enter to pass between the skirt 71 and the exterior of the tube 60. This same arrangement to effect sealing also provides the necessary spring pressure to insure that the detachable connection of the parts will be maintained and provided as desired. The use of ball bearings 59 is of especial importance and value because of the oscillation to which the part is subjected and insures an adequate bearing surface with a minimum area of contact and with a maximum of rolling or friction reducing relative to action. At the same time the bearings, as retained by their respective sockets 58 and 61, provide the necessary fulcrum points for the oscillation and permit the translation of the movement into the orbital movement desired for the brush bristles 82. It will be understood that the spring 76 is illustrative of means which will apply pressure tending to maintain the skirt seal 71 in operative position to hold the bayonet slot in operative position and accommodating the flexibility required for interengagement of the parts of the bayonet slot. Any other resilient means, such as a rubber sleeve integral with the skirt and constrictively encircling a portion of the tube 60, may be provided for this purpose if desired.

A number of other alterations and changes may be made in the construction of the device, and such means particularly may include altered arrangement for translating rotary into oscilla-

tory movement with combined speed reduction in a small space. Another means for that purpose is illustrated in Figs. 7 and 8 which can be substituted for the construction illustrated in Fig. 5. In the construction of Figs. 7 and 8 the motor arbor 38 mounts a pinion 100 which is comparatively thin, and, concentric therewith and in contact with opposite sides of said gear, mounts a pair of rollers 101 whose circumference preferably substantially coincides with the mean pitch diameter of the teeth of the gear or pinion 100. A plurality of combined gear and roller members of different sizes are arranged around the unit 100, 101, each thereof having a central toothed pinion portion 102 and a pair of rollers 103 at opposite sides thereof coinciding with the mean pitch diameter of the pinion portions 102. The parts are so arranged that when the pinions 102 of each unit mesh with the pinion portion 100 of the central arbor mounted unit, the periphery of each roller portion 103 will engage the periphery of the roller portion 101 associated with the pinion 100 and mounted upon the arbor 38. An annular member of laminated construction, including an internally toothed ring gear 104, meshes with the pinion portions 102, and a pair of side flanges 105 at the mean pitch diameter of the teeth of the gear 104 are positioned on opposite sides of the gear 104 so as to have a rolling contact with the circumference of the parts 103 while the teeth 104 mesh with the teeth of the pinion parts 102. By this construction a combined meshed tooth and roller arrangement is provided which serves the same purposes as the unit illustrated in Fig. 5. The same self-lubricating characteristic may be possessed by the various pinions and gears and rollers of this construction as were described with reference to the construction of the gears and pinions in Fig. 5. In other words, these parts may be formed of fiber or sintered or porous metal containing a lubricating agent in its voids or pores, or any other material found suitable. The projecting arm 53 for transmitting the oscillatory movement from the ring gear unit 104, 105 is similar to the part bearing the same number shown in Fig. 5.

A further modified embodiment of the invention with reference to the means for translating rotary to oscillatory movement is illustrated in Figs. 9 and 10. In this instance the motor arbor 38 mounts fixedly a cylindrical member 110 which is surrounded by a series of cylindrical rollers 111 of graduated size, which in turn are received within an annular member 112 having the stem or arm portion 53 projecting therefrom. In this arrangement of the parts, as in the other two arrangements, as the arbor 38 rotates, rotation of the rolls 111 bearing thereagainst occurs and is transmitted to or causes oscillatory movement of small amplitude and at low speed of the member 112.

Still another construction for the same purpose is illustrated in Figs. 11 and 12 wherein the motor arbor 38 mounts an inner raceway 115 engaged by a plurality of ball bearings 116 of graduated size, all confined within a raceway 117 having the arm 53 projecting therefrom.

It will also be understood that the device may be used for purposes other than a tooth brush, and that the shank portion 39 may mount any type of tool found suitable, such as a file, a polishing kit, a cutter or the like.

It will be understood that other modifications and changes may be made in the device within

the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A tool comprising an electric motor having a casing adapted to be held in the hand, motion translating means actuated by said motor and confined in said housing and shiftable in a path having both lateral and longitudinal components, one end of said housing having an opening, a socket member connected to said translating means and positioned in said opening, longitudinally shiftable fulcrum means supporting said socket member in said opening, and a flexible waterproof skirt connecting the outer end of said socket and said housing, said socket being adapted to removably mount a tool shank and having a closed inner end.

2. A tool comprising an electric motor having a casing adapted to be held in the hand, motion translating means actuated by said motor and confined in said housing and shiftable in a path having both lateral and longitudinal components, one end of said housing having an opening, a socket member connected to said translating means and positioned in said opening, longitudinally shiftable fulcrum means supporting said socket member in said opening with clearance and including a pair of balls engaging opposite sides of said socket member intermediate the ends thereof, and a flexible skirt member encircling the projecting end portion of said socket at one end and encircling the adjacent portion of said housing.

3. A tool comprising an electric motor having a casing adapted to be held in the hand, motion translating means actuated by said motor and confined in said housing, one end of said housing having an opening, a socket member connected to said translating means and positioned in said opening, said casing opening and said socket member each having a surface interrupted by a pair of oppositely arranged elongated longitudinal grooves, each groove in one part confronting a groove in the other part, and a ball bearing confined in each pair of confronting grooves.

4. A tool comprising an electric motor having a casing adapted to be held in the hand, motor driven means within said casing for producing oscillatory movement, said casing having an opening, a tool-receiving socket connected to said oscillating means, fulcrum means supporting said socket in said opening with its outer end open and projecting from said casing, a flexible skirt constrictively engaging said casing at one end and sealingly encircling said socket, a tool having a shank fitting in said socket, cooperating detachable interlock means on said socket and tool shank, said shank having an enlargement intermediate its ends encircling the outer end portion of said socket and bearing against the last named end of said skirt.

5. A tool comprising an electric motor having a casing adapted to be held in the hand, motor driven means within said casing for producing oscillating movement, said casing having an opening, a tool receiving socket connected to said oscillating means, fulcrum means supporting said socket in said opening with its outer end open and projecting from said casing, a flexible skirt constrictively engaging said casing at one end and sealingly encircling said socket at its opposite end, a tool having a shank fitting in said socket, cooperating projections and grooves on said socket and tool shank defining a bayonet-type detachable interlock between said socket and

tool shank, and an abutment on said tool shank bearing on said opposite end of said skirt continuously circumferentially.

6. A tool comprising an electric motor having a casing adapted to be held in the hand, motor driven means within said casing for producing oscillating movement, said casing having an opening, a tool-receiving socket connected to said oscillating means, fulcrum means supporting said socket in said opening with its outer end open and projecting from said casing, a flexible skirt constrictively engaging said casing and projecting therefrom and encircling said socket, a tool having a shank fitting in said socket, cooperating detachable interlock means on said socket and tool shank, said shank having an enlargement intermediate its ends encircling the outer end portion of said socket and bearing against an end portion of said skirt, said socket having a continuous external abutment at its mouth and extending therearound, the socket-encircling end portion of said skirt normally bearing continuously against said abutment, said shank enlargement fitting around said socket abutment.

7. A tool comprising an electric motor having a casing adapted to be held in the hand, motor driven means within said casing for producing oscillatory movement, said casing having an opening, a tool-receiving socket connected to said oscillating means, fulcrum means supporting said socket in said opening with its outer end open and projecting from said casing, a flexible skirt constrictively engaging said casing at one end and encircling said socket, a tool having a shank fitting in said socket, cooperating detachable interlock means on said socket and tool shank, said shank having an enlargement intermediate its ends encircling the outer end portion of said socket and bearing against said skirt, said socket having an externally projecting circumferential abutment adjacent to its mouth, and resilient means yieldingly urging said skirt into circumferential engagement with said abutment.

8. A tool comprising an elongated casing of a size adapted to be gripped in the hand and having an aperture at one end, an electric motor mounted in said casing and having a shaft extending transversely in said casing, a tool-receiving socket fulcrumed in said opening, and means positioned in said casing for converting rotary movement into oscillatory movement having a reduced speed compared to the speed of said motor shaft, said last named means including a drive member mounted on said motor shaft and a driven member eccentrically encircling said drive member and connected to said tool socket.

9. A tool comprising an elongated casing of a size adapted to be gripped in the hand and having an aperture at one end, an electric motor mounted in said casing and having a shaft extending transversely in said casing, a tool-receiving socket fulcrumed in said opening, and means positioned in said casing for converting rotary movement into oscillatory movement having a reduced speed compared to the speed of said motor shaft, said last named means including a drive member mounted on said motor shaft and a driven member encircling said drive member and connected to said tool socket, and a plurality of rotatable members confined between and engaging said driving and driven members and of graduated size to position said driven member eccentrically of said driving member.

10. A tool comprising an elongated casing of

a size adapted to be gripped in the hand and having an aperture at one end, an electric motor mounted in said casing and having a shaft extending transversely in said casing, a tool-receiving socket fulcrumed in said opening, and means positioned in said casing for converting rotary movement into oscillatory movement having a reduced speed compared to the speed of said motor shaft, said last named means including a circular part mounted on said motor shaft, an annular non-rotatable member encircling said shaft-mounted part and connected to said socket, a plurality of rotatable elements of different sizes engaging and interposed between said circular part and said annular part to position said parts eccentrically, and means retaining said rotatable elements in operative relation to said driving and driven parts.

11. A tool comprising an elongated casing of a size adapted to be gripped in the hand and having an aperture at one end, an electric motor mounted in said casing and having a shaft extending transversely in said casing, a tool-receiving socket fulcrumed in said opening, and means positioned in said casing for converting rotary movement into oscillatory movement having a reduced speed compared to the speed of said motor shaft, said last named means including a drive member mounted on said motor shaft and a driven member eccentrically encircling said drive member and connected to said tool socket, said motor being of the type having a commutator and brushes, said commutator and brushes being positioned in the casing at the side of the motor opposite said motion converting means.

12. A tool comprising a hollow elongated handle member having an opening at one end, an electric motor mounted in said handle and having an armature shaft extending transversely in said handle, a tool-receiving socket fulcrumed in the opening of said handle member, and a speed reducer of the planetary type confined in said handle with a part thereof carried by said motor shaft and a non-rotating part thereof connected to said socket.

13. A tool comprising an electric motor having a casing adapted to be held in the hand, motor driven means within said casing for producing oscillatory movement, said casing having an opening, a tool-receiving socket connected to said oscillating means, fulcrum means supporting said socket in said opening with its outer end open and projecting from said casing, a flexible skirt constrictively engaging said casing at one end and encircling said socket, a tool having a shank fitting in said socket, cooperating detachable interlock means on said socket and tool shank, said shank having an enlargement intermediate its ends encircling the outer end portion of said socket and bearing against said skirt; and resilient means yieldingly urging said skirt into circumferential engagement with said shank enlargement.

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