March 31, 1942. D. C. DANIELS 2,278,365

ELECTRICALLY ACTUATED APPARATUS

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Fig. 1

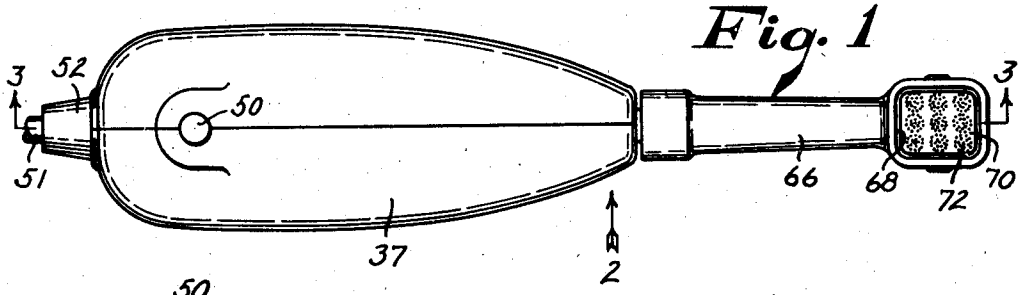


Fig. 2

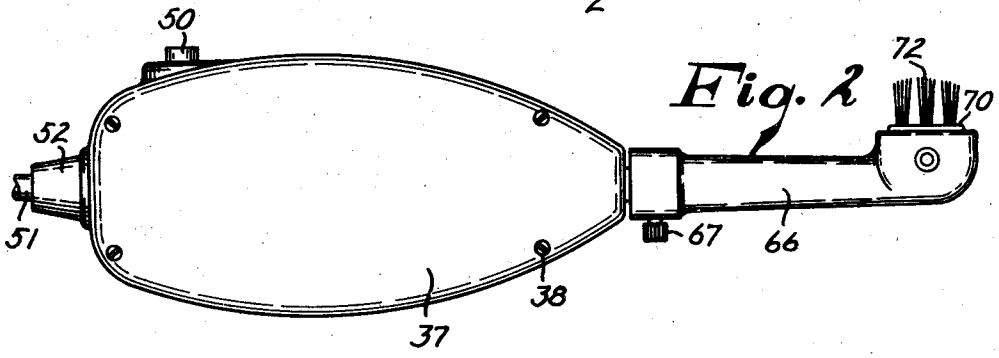


Fig. 3

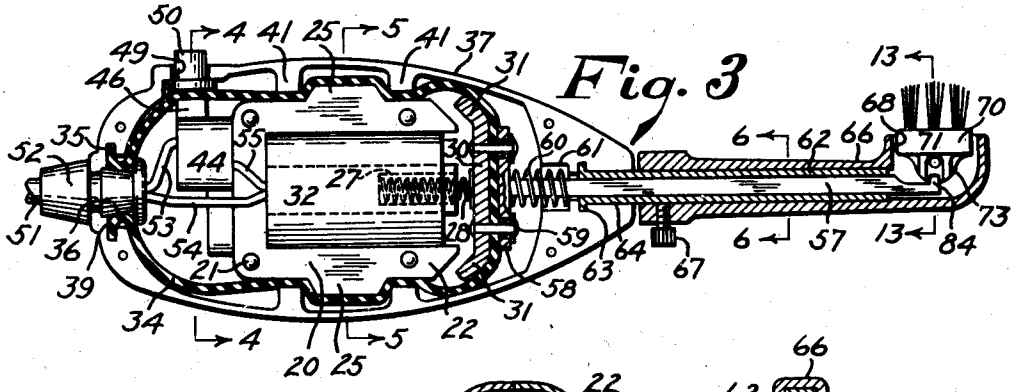


Fig. 4

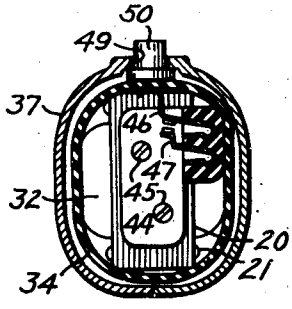


Fig. 5

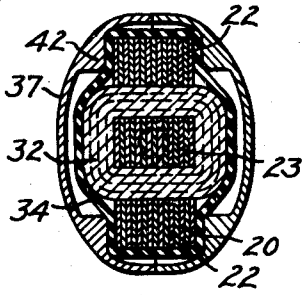
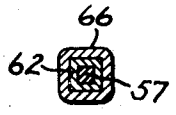


Fig. 6



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ELECTRICALLY ACTUATED APPARATUS

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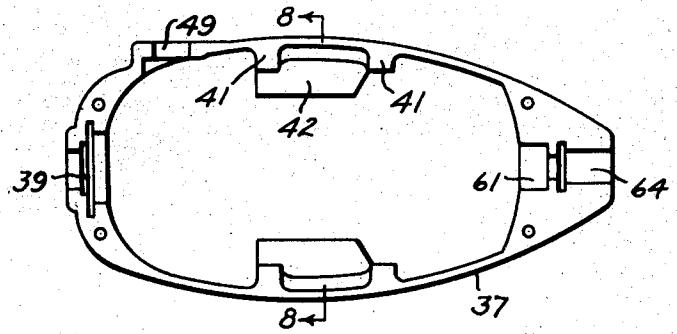


Fig. 7

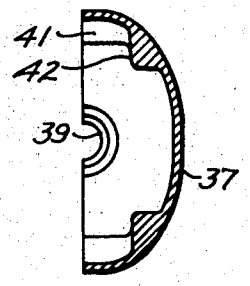


Fig. 8

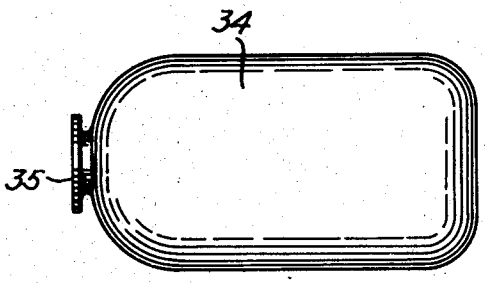


Fig. 9

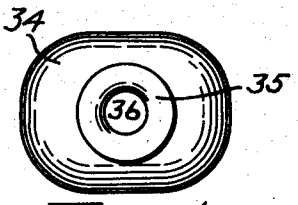


Fig. 10

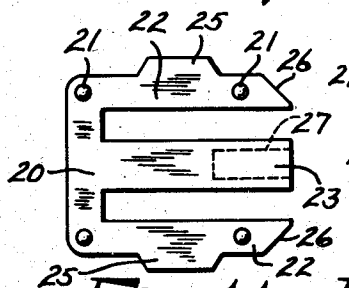


Fig. 11

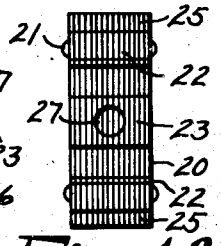


Fig. 12

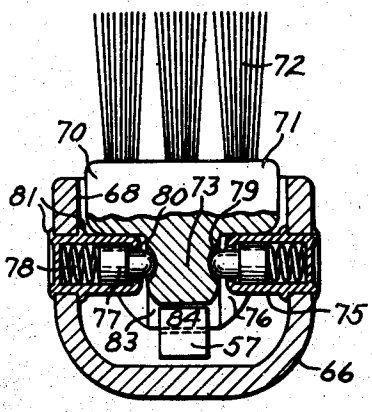


Fig. 13

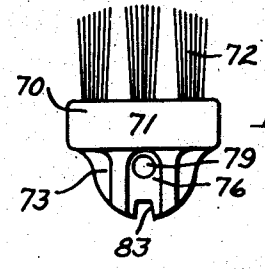


Fig. 14

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UNITED STATES PATENT OFFICE

2,278,365

ELECTRICALLY ACTUATED APPARATUS

Dwight C. Daniels, Worcester, Mass.

Application February 24, 1938, Serial No. 192,342

3 Claims. (Cl. 172—126)

This invention relates to electrically actuated apparatus, and more particularly to small portable appliances, such as electrically driven tooth brushes and the like, which are held in the hand while in use.

Tooth brushes as heretofore constructed for electrical operation have been found unsatisfactory and subject to many difficulties. The motion imparted to the bristles has been so limited as to render the apparatus comparatively ineffective. Water has had ready access to the electrical coils and switches, and this has not only greatly shortened the life of the various parts but it has also created a serious shock hazard to the user. In some cases the vibration encountered in the use of the apparatus has been highly disagreeable. The replaceable brushing element has in some instances been comparatively expensive.

It is accordingly one object of the present invention to provide a portable electrically actuated apparatus which can safely be subjected to considerable quantities of water while in use.

It is a further object of the invention to provide a portable electrically actuated appliance adapted to be held in the hand while in use and so constructed as to avoid disagreeable vibration.

It is a further object of the invention to provide an electrically driven tooth brush in which the bristles will be actuated in a highly effective manner.

It is a further object of the invention to provide a replaceable brushing element which will be comparatively simple and inexpensive to manufacture.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

In accordance with my invention in its preferred form I provide an electric motor, which may be of the reciprocating type, and I enclose this motor in a bag formed of a suitable waterproof material such as rubber. This bag is preferably provided with a restricted opening which may be stretched to admit the motor and through which extend the electrical leads to the motor. The bag is supported within a rigid casing which may be shaped to fit the hand of the user. A switch for the motor may be located within the bag and arranged to be actuated through the wall of the bag by means of a push button or similar device mounted on the casing. When the invention is to be used as a tooth brush I secure a hollow arm to the casing and pass a rod through this arm, the rod being reciprocated by the motor. A small brushing element is mounted on the end of this arm, with the bristles extending substantially at right angles to the arm, and this brushing element is arranged to be oscillated by the reciprocating rod about an axis which is substantially perpendicular to both the arm and the bristles. The brushing element comprises a backing plate having bristles extending from its outer face and a lug extending from its inner face for engagement with the reciprocating rod. The sides of the lug are shaped to fit opposed bearings carried by the arm, these bearings preferably being hollow to receive spring-pressed pins which engage shallow depressions in the lug to hold the brushing element yieldably in place.

Referring to the drawings illustrating one embodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is a side elevation of an electrically actuated tooth brush;

Fig. 2 is an elevation taken in the direction of the arrow 2 in Fig. 1;

Fig. 3 is a view of the apparatus with half of the casing removed and certain parts shown in section on the line 3—3 of Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a section on the line 5—5 of Fig. 3;

Fig. 6 is a section on the line 6—6 of Fig. 3;

Fig. 7 is a detail view of one half-portion of the casing;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is an elevation of the rubber bag;

Fig. 10 is an end elevation of the rubber bag;

Fig. 11 is a detail view of the motor stator;

Fig. 12 is an end elevation of the motor stator;

Fig. 13 is an enlarged section on the line 13—13 of Fig. 3; and

Fig. 14 is a detail view of the brushing element.

The embodiment illustrated comprises an electric motor of the reciprocating or vibrating type having a stator 20 formed by a group of thin laminations of magnetic material held in assembled relationship by means of rivets 21. As shown particularly in Fig. 11, the stator 20 is substantially E-shaped, with two parallel outer branches or poles 22—22, and a central branch or pole 23. Each outer pole 22 is formed on its outer side with a projection 25, and the outer corners at the free ends of the poles 22 are beveled as indicated at 26. The central pole 23 is provided with a longitudinal cylindrical bore

27 extending inwardly from its free end. This bore 27 is arranged to receive a coiled compression spring 28 (Fig. 3) which engages an armature 30 located close to the free ends of the poles 22 and 23. This armature is in the form of a bar of magnetic material having its end portions 31 substantially parallel to the adjacent beveled surfaces 26 of the stator. The central pole 23 of the stator is surrounded by a coil 32 of insulated wire arranged to be supplied with an alternating electric current, so that the armature 30 may be reciprocated toward and away from the stator in a well-known manner.

The motor is enclosed in a bag 34 of a flexible water-proof material, such as rubber, formed at one end with a flanged neck 35 which provides a restricted circular opening 36. The rubber is sufficiently elastic to allow the opening to be stretched for the insertion of the various parts of the motor therethrough at assembly. The bag 34 is enclosed in a rigid hollow casing 37 which is preferably shaped in the approximate form of an ovid of a size adapted to be held readily by the user in one hand. This casing is divided along a central longitudinal plane into two separable parts which are held together by means of screws 38 (Fig. 2). An opening 39 is provided at one end of the casing, this opening being shaped to receive the flanged neck 35 of the bag and form a tight joint therewith. As shown particularly in Figs. 7 and 8, each half of the casing is formed with two pairs of spaced lugs 41 which project inwardly from opposite sides of the casing, and a boss 42 adjacent each pair of lugs arranged to provide a flat shelf. When the parts are assembled, as shown in Figs. 3 and 5, the projections 25 on the motor stator 20 lie between the pairs of lugs 41 and also between the bosses 42. These lugs and bosses hold the wall of the bag firmly against the projections 25 and thus prevent appreciable movement of the stator relative to the casing. Since the rubber forming the bag is of substantial thickness it will absorb to a considerable extent the vibrations resulting from the operation of the motor.

The motor is preferably controlled by means of an electric switch located within the interior of the bag 34 and actuated manually from the outside of the casing 37. For this purpose a switch block 44 of insulating material (Figs. 3 and 4) is attached by means of screws 45 to the rear end of the stator 20, adjacent the opening 36 in the bag. This block 44 is recessed to receive a pair of spring contacts 46 and 47 which are normally separated by a slight space. The casing 37 is provided with an opening 49 in which there is mounted a push button 50, this push button being so located that it may be pressed inwardly against the outer surface of the bag 34 and thus force the contact 46 inwardly against the contact 47 to close the switch. Alternating electric current is supplied by means of a cord 51 which passes through the opening 36 in the bag, this cord having a bushing or enlargement 52 thereon which fits tightly within the opening 39 in the casing and the opening 36 in the bag, to exclude all moisture. The cord 51 is provided with a conductor 53 which leads to the contact 46 and with a conductor 54 which leads to the coil 32. This coil is also connected to the contact 47 by means of a conductor 55. With this arrangement the coil will be energized when the switch is closed.

The armature 30 is arranged to actuate a reciprocable rod 57, preferably square in cross-section, which extends forwardly in a direction perpendicular to the armature. The rear end of the rod 57 is welded or otherwise secured to a plate 58 (Fig. 3) which contacts with the outer surface of the bag 34, and this plate is fastened to the armature by means of rivets 59 which pass through the wall of the bag, and are insulated from the plate. A coiled compression spring 60 surrounds the rear portion of the rod 57, the front end of this spring being supported in a recess 61 in the casing 37 and the rear end of the spring engaging the plate 58 to urge it rearwardly in opposition to the force of the spring 28. The two springs 28 and 60 thus hold the armature 30 yieldably in a predetermined position so long as the coil 32 is de-energized. The rod 57 is slidably supported in a suitable guideway shown as a tube 62 of square cross-section having a flange 63 at its rear end. The rear portion of the tube 62 is mounted in a correspondingly shaped recess 64 in the casing 37.

A hollow arm 66 fits over the outside of the tube 62 and is releasably secured thereon by means of a small set-screw 67 located near the rear end of the arm. At its front end the arm 66 is slightly enlarged and provided with a lateral opening 68 substantially rectangular in shape, as shown in Fig. 1. Within the opening 68 there is mounted a brushing element 70 comprising a backing plate 71 with bristles 72 extending from its outer face and a lug 73 on its inner face. It will be noted from Figs. 2 and 3 that the bristles 72 project outwardly from the opening 68 substantially at right angles to the arm 66.

The brushing element 70 is arranged to be oscillated by the rod 57 about an axis substantially perpendicular to both the arm 66 and the bristles 72. For this purpose two bearings 75 (Fig. 13) are mounted on opposite sides of the opening 68 and extend into recesses 76 on opposite sides of the lug 73. These recesses are open in a direction away from the plate 71, so that the brushing element may be inserted and withdrawn through the opening 68 without disturbing the bearings. In order that the brushing element may be held yieldably in place, the bearings 75 are made tubular to receive small slidable pins or plungers 77 which are urged inwardly by small coiled compression springs 78. The inner ends of the pins 77 are well rounded, and engage shallow depressions 79 in the sides of the lug 73. Inward movement of the pins 77, when the brushing element 70 has been removed, is limited by in-turned flanges 80 on the inner ends of the bearings 75. The outer ends of the bearings are closed to support the springs 78. Flanges 81 are formed on the bearings to hold them firmly in position in the walls of the opening 68. The inner end of the lug 73 is formed with a transverse notch 83, and the rod 57 is provided at its rear end with a tooth 84 arranged to fit within the notch 83 when the parts are assembled, so that reciprocation of the rod in the guideway 62 will cause the brushing element to oscillate about the bearings 75. Since the axis of oscillation is much nearer to the notch 83 than to the outer ends of the bristles 72, these outer ends will swing through an arc of appreciable length even though the amplitude of movement of the rod be rather small.

The operation of the invention will now be apparent from the above disclosure. The user will hold the casing 37 in one hand, and by press-

ing the button **50** inwardly he will close the switch **46—47** and energize the coil **32**. The resultant alternating flux in the stator **20** will cause the armature **30** and the rod **57** to reciprocate. This in turn will oscillate the brushing element **70** about the bearings **75**, producing a very effective motion for the brushing of the teeth or for other purposes. A slight pull on the brushing element will release the lug **73** from the pins **77** and allow removal of the brushing element through the opening **68**. The arm **66** can then be withdrawn from the tube **62** after releasing the set-screw **67**. A separate brushing element **70** and arm **66** may be provided for the use of each member of a family, only one casing and motor being required.

Water cannot damage the apparatus, since the switch and motor are entirely enclosed in the water-proof rubber bag **34**. This bag also absorbs much of the vibration of the motor and serves as an excellent insulating shield to protect the user from possible shock hazard. The brushing element **70** is of a simple and inexpensive construction, and is readily replaceable.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electrically actuated apparatus comprising a stator of magnetic material, a coil mounted thereon, a reciprocable armature arranged to be actuated by the stator and coil, a bag of flexible water-proof material enclosing the stator, coil and armature, a rigid casing formed in two separable parts enclosing the bag and arranged to hold the wall of the bag firmly against the stator at a plurality of points to prevent appreciable movement of the stator relative to the casing, a guideway supported by the casing, a rod reciprocable in the guideway in alignment with the armature, and means connecting the armature, the rod and the intervening portion of the bag.

2. An electrically actuated apparatus comprising a stator of magnetic material, a coil mounted thereon, a reciprocable armature arranged to be actuated by the stator and coil, a bag of flexible water-proof material enclosing the stator, coil and armature, a rigid casing enclosing the bag and arranged to hold the wall thereof firmly against the stator at a plurality of points to prevent appreciable movement of the stator relative to the casing, a member mounted on the casing and adapted to be moved relative thereto, and means connecting the armature, the movable member and the intervening portion of the bag.

3. An electrically actuated apparatus comprising a stator of magnetic material, a coil mounted thereon, a movable armature arranged to be actuated by the stator and coil, a rubber bag enclosing the stator, coil and armature, a rigid casing enclosing the bag and arranged to hold the wall thereof firmly against the stator at a plurality of points to prevent appreciable movement of the stator relative to the casing, a member mounted on the casing and adapted to be moved relative thereto, and means connecting the armature to said member through the intervening portion of the bag.

DWIGHT C. DANIELS.