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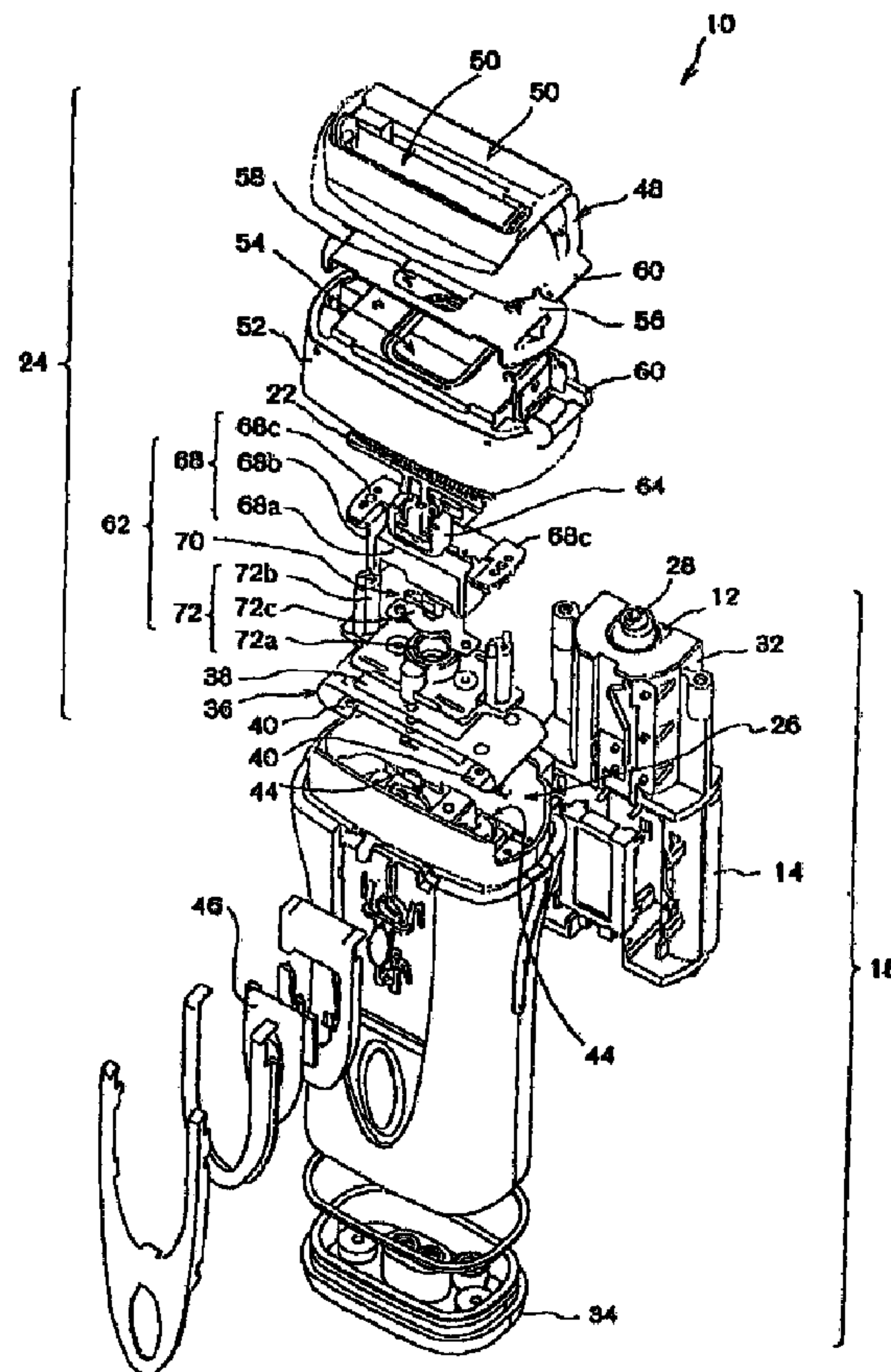
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(54) Title: ELECTRIC SHAVER



(57) Abrégé/Abstract:

An electric shaver comprising a main body case which contains an electric motor, and a cutter head section which contains an outer cutter and an inner cutter and is attached to an upper portion of the main body case, in which the shaver further includes a



(57) **Abrégé(suite)/Abstract(continued):**

supporting member that has a supporting plate body and leg portions and is provided on an upper portion of the main body case via the leg portions that has elasticity and disposed on both ends of the supporting plate body, and the cutter head section is provided on the supporting plate body.

ABSTRACT

An electric shaver comprising a main body case which contains an electric motor, and a cutter head section which contains an outer cutter and an inner cutter and is attached to an upper portion of the main body case, in which the shaver further includes a supporting member that has a supporting plate body and leg portions and is provided on an upper portion of the main body case via the leg portions that has elasticity and disposed on both ends of the supporting plate body, and the cutter head section is provided on the supporting plate body.

ELECTRIC SHAVER

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to an electric shaver and more particularly to an improved cutter head section in an electric shaver.

2. PRIOR ART

10 Electric shavers are generally constructed to have a main body case and a cutter head section. The main body case is held in a user's hand during shaving, and it contains an electric motor, a power supply switch and a power supply that supplies power to the electric motor. The cutter head section is mounted on the upper portion of the main body case, and it contains an outer cutter and inner cutter.

In recent electric shavers, the cutter head sections are designed so as to pivot. In other words, the cutter head section pivots with respect to the main body case in accordance with the shape of the face (thus so-called "swinging of the head") when the main body case is held in a user's hand and the electric shaver is moved with the
20 outer cutter pressed against the skin. As a result, the outer cutter can be held in tight contact with the skin for a longer period of time to cut hair more efficiently. Such electric shavers have been commercialized.

The swinging-head structure as described above is generally made by attaching the cutter head section to the upper portion of the main body case so that the cutter head section can pivot through a specified angle about a single predetermined axial line. In one example, this axial line is set parallel to the direction of width of the main body case as disclosed in Japanese Patent Application Laid-Open (Kokai) No. H6-126043.

However, in the above head-swinging type structure, the pivoting direction of the cutter head section with respect to the main body case is fixed. As a result, the outer cutter cannot always be made to make a snug contact with the skin when the cutter head section is merely moved while the electric shaver is being moved along the surface of the face. This is because the face surface is uneven, and there are variations in shape. Accordingly, the user needs to incline the main body case, which is held in a hand, in order to achieve an appropriate match with the contour of the skin. Thus, conventional electric shavers are not completely convenient for actual use.

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SUMMARY OF THE INVENTION

Accordingly, a feature of one embodiment of the present invention is to solve the above-described problems. More specifically, according to certain embodiments of the present invention there is provided an electric shaver in which a cutter head section can be moved in all directions with respect to the main body case of the electric shaver upon receipt of an external force from the skin.

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Furthermore, according to other embodiments of the present invention there is provided an electric shaver in which the outer cutter is able to make a snug or close contact with the skin surfaces of a user's face which may have a varying contour, during shaving.

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The above-described features are accomplished by, in certain embodiments, a unique structure for an electric shaver that comprises: a main body case which contains an electric motor, and a cutter head section which contains an outer cutter and an inner cutter and is provided on an upper portion of the main body case, and the unique structure of the present invention is characterized in that there is provided a supporting member comprised of a supporting plate body and leg portions is provided in an upper portion of the main body case via leg portions that consist of resilient means (preferably of elastic material) disposed on both ends of

the supporting plate body, and the cutter head section is mounted on the thus provided supporting plate body of the supporting member.

In preferred embodiments, the cutter head section is fastened to the supporting member, and this supporting member is installed or positioned in the upper portion of the main body case via elastic leg portions.

10 Accordingly, when, upon use of the shaver, the cutter head section contacts the skin and receives an external force from the skin, the leg portions undergo elastic deformation in accordance with the magnitude and direction of the external force. As a result, the cutter head section, more specifically the outer cutter that is inside the cutter head section and which is in contact directly with the skin, can be moved all directions with respect to the main body case. In other words, the outer cutter makes a swivel motion without any specified fulcrum or specified axial line and makes a constant snug contact with the skin.

When the cutter head section is removed from the skin, the elastically deformed leg portions return to their original shape, and as a result the cutter head section also returns to its initial position with respect to the main body case.

20 In the above electric shaver, the supporting member is constructed from a plate spring in which both ends thereof are bent in the same direction to form the leg portions, and a plate-form portion located between the leg portions is used as the supporting plate body. Thus, the structure of the supporting member is simple, and fewer components are required. The cost of the shaver also can be reduced.

Furthermore, in the electric shaver of the present invention, the inner cutter can be structured to perform a reciprocating motion with respect to the outer cutter. In this case, it is preferable to provide, inside the cutter head section, a conversion mechanism that converts the rotational motion of the output shaft of the electric

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motor into a linear motion that causes the inner cutter to perform the reciprocating motion.

With this structure, the leg portions which are made from elastic material are interposed between the conversion mechanism, which converts the rotational motion into a linear motion and generates the greatest vibration, and the main body case that is held in a user's hand during use of the shaver. Accordingly, the vibration generated by the conversion mechanism is absorbed by the leg portions, and the vibration transmitted to the main body case is reduced. Thus, unpleasant vibrations to the user are thus avoided, and the convenience of use is improved.

Furthermore, preferably a coil spring is mounted on an output shaft of the electric motor so that the rotational motion of the output shaft is transmitted to the interior of the cutter head section via the coil spring. With this structure, the rotational motion is reliably transmitted to the cutter head section or to the inner cutter while the coil spring deforms in accordance with the deformation of the leg portion of the supporting member. Moreover, the cost of parts is greatly reduced compared to a structure that uses an expandable universal joint. Also, since the structure is simple, shaver malfunction can be reduced.

Furthermore, in preferred embodiments of the above electric shaver of the present invention, locking assemblies are provided in the main body case. The locking assemblies are set at a deformation-restricting position in which the locking assemblies contact the undersurface of the supporting plate body and restrain elastic deformation of the leg portions and at a deformation-permitting position in which the locking assemblies are separated from the undersurface of the supporting plate body and permit the elastic deformation of the leg portions. More specifically, each locking assembly is provided with a supporting element, and one end of the supporting element is pivotally structured so that the other end is movable in a circular arc.

With this structure, it is possible to regulate the movement of the cutter head section with respect to the main body case. Hair can be thus shaved with the cutter head section pressed firmly against the skin while the user tilts and moves the main body case in accordance with the contour of the skin. It is, thus possible for the user to shave at a user's desired angle.

10 According to a further embodiment of the invention, there is disclosed a combination of a cutter head member and a supporting member for use in an electric shaver, said supporting member comprising a supporting plate body having free ends and leg portions, said supporting member being adapted to be secured in a main body case of an electric shaver via said leg portions, said leg portions including resilient means and being disposed on said ends of said supporting plate body; and said cutter head section being adapted to be mounted on said supporting plate body.

Preferably, in the combination of cutter head member and a supporting member for use in an electric shaver as described above, the supporting member is a plate spring, said ends being bent in the same direction so as to form said leg portions, said supporting plate body comprising a plate-form portion located between said leg portions.

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BRIEF DESCRIPTION OF THE DRAWINGS

Having thus generally described the invention, reference will be made to the following figures, describing preferred embodiments of the invention, and in which:

Figure 1 is a sectional view of the structure of one embodiment of the electric shaver according to the present invention;

Figure 2 is an exploded perspective view of the structure of one embodiment of the electric shaver of the present invention;

Figure 3 is an enlarged view showing the essential portion of the structure of the connecting parts of the cutter head section and main body case in Figure 1.

30 Figure 4 is an explanatory diagram mainly showing the structure of a pair of

locking assemblies used in the shaver of the present invention, the locking assemblies being in the deformation-permitting position; and

Figure 5 is an explanatory diagram mainly showing the structure of the locking assemblies used in the shaver of the present invention, the locking assemblies being in the deformation-restricting position.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the electric shaver of the present invention will be described in detail below with reference to the accompanying drawings. The invention will be described with reference to a reciprocating electric shaver.

First, the construction of the electric shaver will be described with reference to Figures 1 through 4.

The reciprocating electric shaver 10 is essentially comprised of a main body case 18 and a cutter head section 24. Inside the main body case 18 there is provided an electric motor 12 and a power supply (battery 14 and AC/DC converter 16) that supplies power to the electric motor 12, etc. The cutter head section 24 is mounted on the upper portion of the main body case 18. The cutter head section 24 contains an outer cutter 20 and an inner cutter 22 that performs a reciprocating motion with respect to the outer cutter 20.

The main body case 18 is formed as a tubular body and is designed externally so as to be easily held in hand of the user (the cross section of the main body case 18 being in, for instance, an oval shape, a rectangular shape with rounded corners, etc.). In the upper portion of the main body case 18 is formed an accommodating recess section 26 in which the supporting member (described later) and other parts are accommodated. A first through-hole 30 through which the output shaft 28 of an electric motor 12 is passed is formed in the center of the inside bottom of the accommodating recess section 26.

An inner case 32 is attached to the interior of the main body case 18, and an electric motor 12 and battery 14 are installed in this inner case 32. When an AC/DC converter 16 is employed, the converter 16 can also be installed in the inner case 32.

The battery 14 is mounted in the inner case 32 and can be removed from the inner case 32 by attaching and detaching a main body lower case 34, which is detachably attached to the lower opening portion of the main body case 18.

10 The output shaft 28 of the electric motor 12 is passed through the first through-hole when the inner case 32 is installed in a specified position inside the main body case 18. The tip end of the output shaft 28 protrudes into the accommodating recess section 26.

Furthermore, a supporting member 36 is attached to the inside bottom surface of the accommodating recess section 26 of the main body case 18 so that the supporting member 36 covers the first through-hole 30.

20 More specifically, the supporting member 36 has a supporting plate body 36a and a pair of leg portions 36b. The leg portions 36b are made of elastic material and are disposed on both ends of the supporting plate body 36a. The lower ends of the respective leg portions 36b are fastened to the inside bottom surface of the accommodating recess section 26 so that the first through-hole 30 is positioned between the respective leg portions 36b. The supporting member 36 is thus provided on the upper portion of the main body case.

30 In the shown embodiment, the supporting member 36 is constructed using a plate spring. Both ends of this plate spring are bent in the same direction (i.e., toward the same side of the plate spring) into a cross-sectional U shape (a cross-sectional C shape, L shape, horizontal V shape, horizontal W shape, etc. may also be used) so

as to form the leg portions 36b. The plate-form (flat) portion located between the leg portions 36b constitutes the supporting plate body 36a.

The supporting plate body 36a and the leg portions 36b can be separately formed. In this case, these parts are connected to each other to form the supporting member 36. However, forming the supporting member 36 by working a single plate spring as in the shown embodiment results in a reduction in the number of parts required. Also, such a supporting member 36 can be manufactured easily with a sufficient durability. In cases where the supporting plate body 36a and leg portions 36b are formed separately, the leg portions 36b can be constructed from various types of elastic members. In other words, the leg portions 36b can be formed of spring members such as coil springs, plate springs, etc. Further, the leg portions 36b can be formed into masses such as columnar bodies, etc. using rubber.

Furthermore, the cutter head section 24 is mounted on the supporting plate body 36a of the supporting member 36. Thus, so as to increase the rigidity of the supporting plate body 36a and keep its planar shape, first auxiliary plates 38 are tightly attached to the top surface and undersurface of the plate-form portion of the plate spring that constitutes the supporting plate body 36a. Furthermore, second auxiliary plates 40 are also installed on both end edges of the plate spring that constitute the respective leg portions 36b for the same reason as the above-described auxiliary plates 38.

When sufficient rigidity is obtained using a plate spring alone, the first auxiliary plates 38 and second auxiliary plates 40 can be omitted.

With the structure described above, the supporting plate body 36a is supported by the leg portions 36b so that the supporting plate body 36a is positioned in a more or less parallel attitude above the first through-hole 30 that is located above the inside bottom surface of the accommodating recess section 26 with a space in between.

When an external force is applied to the supporting plate body 36a, a force with a magnitude corresponding to the magnitude of such external force acts in a direction corresponding to the direction of the external force on the respective leg portions 36b via the supporting plate body 36a. Thus, the respective leg portions 36b that have elasticity can undergo deformation independently of each other; and the supporting plate body 36a freely moves in all directions (by tilting, sinking, twisting and pivoting) inside the accommodating recess section 26. When the external force is removed, the respective leg portions 36b return to their original positions as a result of their own elastic force; and as well the supporting plate body 36a also returns to its initial position.

In the above structure, it is necessary to transmit the rotation of the output shaft 28 of the electric motor 12 that protrudes from the first through-hole 30 positioned beneath the supporting member 36 to the cutter head section 24 which is provided on the supporting member 36 in such a manner that it can move in all directions. For this purpose, a second through-hole 42 through which a coil spring (described later) is passed is formed in the supporting member 36. In other words, the second through-hole 42 is formed in the supporting plate body 36a of the supporting member 36.

Furthermore, a pair of locking assemblies 44 are disposed on the inside bottom surface of the accommodating recess section 26 so that each locking assembly 44 is on either side of the first through-hole 30. The locking assembly 44 is substantially comprised of two supporting elements 44a, a shaft 44b, and an operating element 44c. The locking assemblies 44 are disposed so as to be surrounded by the leg portions 36b of the supporting member 36 and so as to be pivotable about axial lines -- A -- that extend in the direction of the thickness of the main body case 18.

More specifically, the locking assemblies 44 are provided so as to be set at a

deformation-restricting position B and at a deformation-permitting position C.

At the deformation-restricting position B, the upper ends of the locking assemblies 44 (more specifically the upper ends of the supporting elements 44a described hereinafter) contact the undersurface of the supporting plate body 36a, thus restricting the elastic deformation of the leg portions 36b and restricting the movement of the supporting plate body 36a even if an external force is applied to the supporting plate body 36a. In other words, the deformation-restricting position B is the position in which the locking assemblies 44 are raised into an upright attitude from the inside bottom surface of the accommodating recess section 26 as shown in Figure 5.

At the deformation-permitting position C, the locking assemblies 44 rotate toward the first through-hole 30, so that the tip ends of the locking assemblies 44 (more specifically the upper ends of the supporting elements 44a) are separated from the undersurface of the supporting plate body 36a, thus permitting the leg portions 36b to make an elastic deformation. In other words, the deformation-permitting position C is the position in which the locking assemblies 44 lie flat above the inside bottom surface of the accommodating recess section 26 as shown in Figures 1, 3 and 4.

In Figure 2, the locking assemblies 44 are respectively oriented in different positions. However, these positions are shown only for the purpose of convenience of description. Both locking assemblies 44 are ordinarily positioned in the same position.

Each locking assembly 44 has two supporting elements 44a, so that a total of four supporting elements 44a are respectively disposed beneath the four corners of the supporting plate body 36a. One end of each supporting element 44a of each locking assembly 44 is pivotally provided so that another end of the supporting element 44a is moved along a circular arc. Such one end of the supporting element 44a can be

provided by a dovetail engagement on the case body 18. Instead, the supporting element 44a can be disposed on a shaft. The supporting element 44a is, for instance, rectangular in external shape with its shorter sides rounded.

More specifically, the supporting elements 44a of each locking assembly 44 are provided at either end of the shaft 44b that are disposed on an axial line - - A - - so that the supporting elements 44a can pivot around the shaft 44b. The supporting elements 44a are pivoted in linkage with each other so that the two supporting elements 44a always have the same rotational angle with respect to the inside bottom surface of the accommodating recess section 26. A driving means (e.g., a torsion coil spring, etc.; not shown) which constantly urges the supporting elements 44a in the direction that causes the supporting elements 44a to lie flat on the inside bottom surface of the accommodating recess section 26 is installed on each locking assembly 44.

The supporting elements 44a of each locking assembly 44 can be formed in a single long columnar element that has the same cross-sectional shape from one end to the other. With this structure, edge areas of the supporting plate body 36a in the direction parallel to the leg portions 36b are supported in their entirety by the locking assemblies 44. Thus, the support for the supporting plate body 36a is stabilized.

The supporting elements 44a need not be limited to the shape described above. The supporting elements 44a may have a non-circular shape cross-sectional. In this case, one end of each supporting element 44a is pivotally attached to the main body case 18 (via a shaft, for instance) so that the other end of the supporting element 44a moves in a circular arc. Furthermore, the cross-sectional shape of the supporting elements 44a can be circular. In this case, substantially the same function can be fulfilled by pivotally attaching each supporting element 44a to the main body case 18 at an eccentric position thereof.

Furthermore, operating elements 44c are provided on the supporting elements 44a so as to be located on the same side in the direction of the axial line A. The operating elements 44c are disposed so as to protrude from the surface of the main body case 18. A locking button 46 is disposed on the surface of the main body case 18 on the side from which the operating elements 44c protrude. The locking button 46 is disposed so as to slide in the direction of the length of the main body case 18, the direction shown by arrow Z in Figure 4.

10 With the above structure, when the locking button 46 is caused to slide toward the operating elements 44c (thus being slid upward), the operating elements 44c are pushed upward toward the upper portion of the main body case 18. As a result, the supporting elements 44a of the locking assemblies 44 pivot about the shafts 44b against the driving force of the driving means (spring). Thus, the supporting elements 44a are moved from the deformation-permitting position C shown in Figure 4 in which the supporting elements 44a of the locking assemblies 44 lie flat on the inside bottom surface of the accommodating recess section 26 to the deformation-restricting position B shown in Figure 5 in which the supporting elements 44a stand upright on the inside bottom surface of the accommodating recess section 26.

20 In the deformation-restricting position B, the tip or upper ends of the supporting elements 44a of the respective locking assemblies 44 contact the undersurfaces of the supporting plate body 36a, and the four corners of the supporting plate body 36a are supported by the supporting elements 44a. Accordingly, the movement of the supporting plate body 36a is restricted. When the locking button 46 is caused to slide in the opposite direction from the operating elements 44c (thus being slid downward), the supporting elements 44a of the respective locking assemblies 44 are caused to pivot by the driving force of the driving means in the direction that causes the supporting elements 44a to lie flat. As a result, the supporting elements 44a automatically return to the deformation-permitting position C shown in Figure 4.

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In an outer cutter frame stand 48, for instance, two outer cutter holders 50 are installed side by side. Each outer cutter holder 50 is provided so as to move independently in the vertical direction (or toward the main body case 18) by a specified amount. Furthermore, outer cutter 20 is respectively attached to the respective outer cutter holders 50.

10 The cutter frame attachment stand 52 is formed in the shape of an inverted cup which fits over the upper portion (accommodating recess section 26) of the main body case 18. The lower part of the cutter frame attachment stand 52 is formed with a double wall structure, having the outer wall 52a and the outer wall 52b. The inner circumferential shape of the outer wall 52a of the cutter frame attachment stand 52 is similar to the outer circumferential shape of the tubular wall of the accommodating recess section 26 and is formed so as to be slightly larger than the tubular wall surface. On the other hand, the outer circumferential shape of the inner wall 52b of the cutter frame attachment stand 52 is similar to the inner circumferential shape of the tubular wall of the accommodating recess section 26 and is formed so as to be slightly smaller than the tubular wall.

20 As a result, the cutter frame attachment stand 52 is fitted over the upper portion of the main body case 18 in a labyrinth structure in which the tubular wall surface of the accommodating recess section 26 is inserted into the ring-form space formed between the outer wall 52a and inner wall 52b of the cutter frame attachment stand 52. The width of the space formed by the outer wall 52a and inner wall 52b is set so that the cutter frame attachment stand 52 and accommodating recess section 26 do not interfere with each other even if the cutter frame attachment stand 52, i.e., the cutter head section 24, is moved to some extent.

The cutter frame attachment stand 52 is formed with a third through-hole 54 so as to open in the center of the upper wall thereof.

A fulcrum plate spring 56 is attached to the upper surface of the upper wall surface of the cutter frame attachment stand 52, and a fourth through-hole 58 is opened in this fulcrum plate spring 56 in a position corresponding to the third through-hole 54. The fulcrum plate spring 56 functions so that the outer cutter holders 50 attached to the outer cutter frame stand 48 are constantly driven upward with respect to the outer cutter frame holder 48 and so that even in cases where the outer cutter holders 50 are pushed into the outer cutter frame stand 48 by an external force, the outer cutter holders 50 will return to their original positions when this external force is eliminated.

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The outer cutter frame stand 48 is attached to the cutter frame attachment stand 52 via the connecting part 60 of a hinge structure so that the outer cutter frame stand 48 is free to open and close.

An oscillating mechanism 62 is installed inside the cutter frame attachment stand 52. The oscillating mechanism 62 converts the rotational motion of the output shaft 28 of the electric motor 12 into a linear reciprocating motion, thus causing the inner cutter 22 to perform a reciprocating motion,.

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This oscillating mechanism 62 is inserted into the interior of the cutter frame attachment stand 52 from beneath the cutter frame attachment stand 52 and is fastened to the upper wall of the cutter frame attachment stand 52. In this state, an inner cutter connecting part 64 which extends from the upper part of the oscillating mechanism 62 passes through both the third through-hole 54 formed in the cutter frame attachment stand 52 and the fourth through-hole 58 formed in the fulcrum plate spring 56, thus protruding from the cutter frame attachment stand 52. inner cutter 22 is attached to this inner cutter connecting part 64.

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The output shaft 28 of the electric motor 12 and the oscillating mechanism 62 are connected by a coil spring 66 that is disposed so as to pass through the second

through-hole 42 formed in the supporting plate body 36a. In this way, the rotational motion of the output shaft 28 is transmitted to the oscillating mechanism 62. The reason that a coil spring 66 is used is as follows: in the electric shaver 10 of this embodiment, the cutter head section 24 receives an external force from the skin and freely move with respect to the main body case 18; accordingly, it is necessary for the cutter head section 24 to be able to bend, retract, extend and turn with respect to the main body case 18 in accordance with this movement.

10 The structure of the oscillating mechanism 62 itself is the same as that of the conventional mechanism. Accordingly, in the following, a detailed description of the oscillating mechanism 62 will be omitted.

The oscillator 68 is comprised of a moving stand 68a to which the inner cutter connecting part 64 is attached, a pair of U-shape bodies 68b which are installed on both sides of the moving stand 68a, and a pair of fastening stands 68c which support the moving stand 68a via the pair of U-shaped bodies 68b so that the moving stand 68a can perform a linear reciprocating motion.

20 The conversion mechanism 70 installed beneath the oscillator 68 has the function of converting a rotational motion into a linear reciprocating motion. This mechanism is comprised of: a rotating disk 70a which is rotatably connected to the output shaft 28 of the electric motor 12 by the coil spring 66, two pins 70b which are installed in an upright attitude in positions that are eccentric with respect to the rotational axis D of the rotating disk 70a, and two links 70c which are connected at one ends thereof to the respective pins 70b. The other ends of the links 70c are connected to the moving stand 68a or U-shaped bodies 68b. Furthermore, of the two pins 70b, the lower pin 70b is installed in an upright attitude on the rotating disk 70a, while the upper pin 70b is installed in an upright attitude on another disk-form body 70d that is attached to the lower pin 70b.

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The oscillating base 72 is installed beneath the conversion mechanism 70 and has a guide tube 72a and a pair of supporting columns 72b. The guide tube 72a guides the rotating disk 70a so that the rotating disk 70a is rotatable about its axial line D. The supporting columns 72b are disposed so as to protrude on either side of the guide tube 72a. The spacing of the supporting columns 72b is set so that it is wider than the spacing of the pair of U-shaped bodies 68b of the oscillator 68. The upper end surfaces of the supporting columns 72b are screw-fastened to the upper wall surface of the cutter frame attachment stand 52 so that they clamp the fastening stands 68c of the oscillator 68, thus connecting the cutter frame attachment stand 52, oscillator 68 and oscillating base into an integral unit.

Furthermore, the oscillating base 72 is fastened to the supporting member 36, so that the cutter head section 24 as a whole is attached to the supporting member 36.

The rotating disk 70a disposed inside the guide tube 72a is connected to the output shaft 28 by means of the coil spring 66 and is constantly driven upward by the driving force of the coil spring 66. Accordingly, a fastening fitting 72c which closes off the opening part of the guide tube 72a in a state in which only the central area of the rotating disk 70a on which the pins 70b are installed in an upright attitude is exposed is attached to the guide tube 72a by means of screws so that the rotating disk 70a is prevented from slipping out from the upper end of the guide tube 72a.

The operation of the electric shaver 10 having the above-described structures of the cutter head section 24 and main body case 18 will be described.

When whiskers are to be shaved with the electric shaver 10, the main body case 18 is held in the user's hand, and the outer cutter 20 of the cutter head section 24 is placed against the skin. In this case, the outer cutter 20 first moves while sinking into the interior of the outer cutter frame holder 48 against the elastic force (driving force) of the fulcrum plate spring 56, or appropriately tilting, etc., in accordance with

variations in the contour of the skin, so that the outer cutter 20 can be maintained in a snug or tightly adhering configuration against the skin.

In cases where there are variations in the contour of the skin that cannot be absorbed by the movement of the outer cutter 20 alone, i.e., in cases where the outer cutter 20 has moved to the deepest part of the outer cutter frame stand 48 and cannot move any further, the external force from the skin causes the cutter head section 24 itself to perform movements such as tilting and sinking, etc. As a result of the elastic deformation of the leg portions 36b of the supporting member 36, the outer cutter 20 is maintained in tight contact with the skin.

Ordinarily, the elastic force of the leg portions 36b that support the cutter head section 24 is set so that it is considerably greater than the elastic force of the fulcrum plate spring 56 that drives the outer cutter 20. Accordingly, the outer cutter 20 is moved first, followed by the cutter head section 24 as described above. Thus, if the difference between the elastic force of the leg portions 36b and the elastic force of the fulcrum plate spring 56 is small, the cutter head section 24 would be moved slightly together with the movement of the outer cutter 20.

For users who do not desire the cutter head section 24 to be moved, the locking button 46 is used. The locking button 46 is caused to slide so that the locking assemblies 44 are shifted from the state shown in Figure 4 to the state shown in Figure 5. As a result, the supporting plate body 36a of the supporting member 36 is supported from underneath by the locking assemblies 44. Thus, even if an external force is applied to the cutter head section 24, the elastic deformation of the leg portions 36b is restricted, and the movement of the cutter head section 24 is consequently restricted.

In the above-described electric shaver, the oscillating mechanism 62 that generates the largest vibration when it changes rotational motion into linear reciprocating

motion is installed inside the cutter head section 24, which is connected to the main body case 18 via the elastically deformable leg portions 36b. Thus, inside the main body case 18 that is actually held in the user's hand only the electric motor 12 is installed that performs only a rotational motion which generates a small vibration compared to the oscillating mechanism 62. Accordingly, the vibration generated by the oscillating mechanism 62 is absorbed by the leg portions 36b and is therefore not transmitted to the main body case 18. Undesirable vibrations that are transmitted to the hand are thus reduced, thus improving the convenience to the user.

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The above embodiment is described with reference to a reciprocating type electric shaver. However, the structure of the present invention, in which the electric shaver is divided into a cutter head section and a main body case that is held in a user's hand, and such two parts are connected by an elastically deformable member such as the supporting member, can be applied to a rotary type electric shaver.

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As seen from the above, in the electric shaver of the present invention, the cutter head section is provided on a supporting plate body that is attached to the upper portion of the main body case via leg portions that has elasticity. Accordingly, when the cutter head section contacts the skin and receives an external force from the skin, the leg portions undergo elastic deformation in accordance with the magnitude and direction of such an external force. As a result, the cutter head section, more specifically, the outer cutter that contacts the skin directly and is provided inside the cutter head section, performs truly three-dimensional movements without any specified fulcrum or specified axial line relative to the main body case, and the outer cutter is constantly able to be in contact with the skin. Accordingly, it is not always necessary for users to move the main body case of the shaver in accordance with variations in the contour of the skin, and the convenience of use of the shaver is improved.

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CLAIMS:

1. In an electric shaver comprising an electric motor and a cutter head section secured in a main body case, said cutter head section having an outer cutter and an inner cutter, the improvement comprising:
a supporting member comprising a supporting plate body having free ends and leg portions, said supporting member being adapted to be secured in said main body case via said leg portions, said leg portions including resilient means and being disposed on said ends of said supporting plate body; and
said cutter head section being adapted to be mounted on said supporting plate body.
2. The electric shaver according to claim 1, wherein said supporting member is a plate spring, said ends being bent in the same direction so as to form said leg portions, said supporting plate body comprising a plate-form portion located between said leg portions.
3. The electric shaver according to claim 1 or 2, wherein said inner cutter is adapted to function in a reciprocating motion with respect to said outer cutter, and said shaver further having a conversion means inside said cutter head section, said motor having an output shaft, said conversion means converting a rotational motion of said output shaft into a linear motion to thereby cause said inner cutter to perform said reciprocating motion.
4. The electric shaver according to any one of claims 1 to 3, further including a coil spring mounted on said output shaft of said electric motor whereby rotational motion of said output shaft is transmitted to an interior of said cutter head section via said coil spring.

5. The electric shaver according to any one of claims 1 to 4, further comprising a locking assembly in said main body case, said locking assembly when positioned at a deformation-restricting position contacts an undersurface of said supporting plate body and restrains resilient deformation of said leg portions, and wherein when said locking assembly is positioned at a deformation-permitting position, it is separated from said undersurface of said supporting plate body, and permits resilient deformation of said leg portions.
6. The electric shaver according to claim 5, wherein said locking assembly includes a supporting element having first and second ends, said first end being pivotally attached to said main body case and said second end being movable in a circular arc.
7. In combination, a cutter head member and a supporting member for use in an electric shaver, said supporting member comprising a supporting plate body having free ends and leg portions, said supporting member being adapted to be secured in a main body case of an electric shaver via said leg portions, said leg portions including resilient means and being disposed on said ends of said supporting plate body; and said cutter head section being adapted to be mounted on said supporting plate body.
8. The combination according to claim 7, wherein said supporting member is a plate spring, said ends being bent in the same direction so as to form said leg portions, said supporting plate body comprising a plate-form portion located between said leg portions.
9. The electric shaver according to any one of claims 1 to 5, wherein said resilient means is an elastic member.

FIG. 1

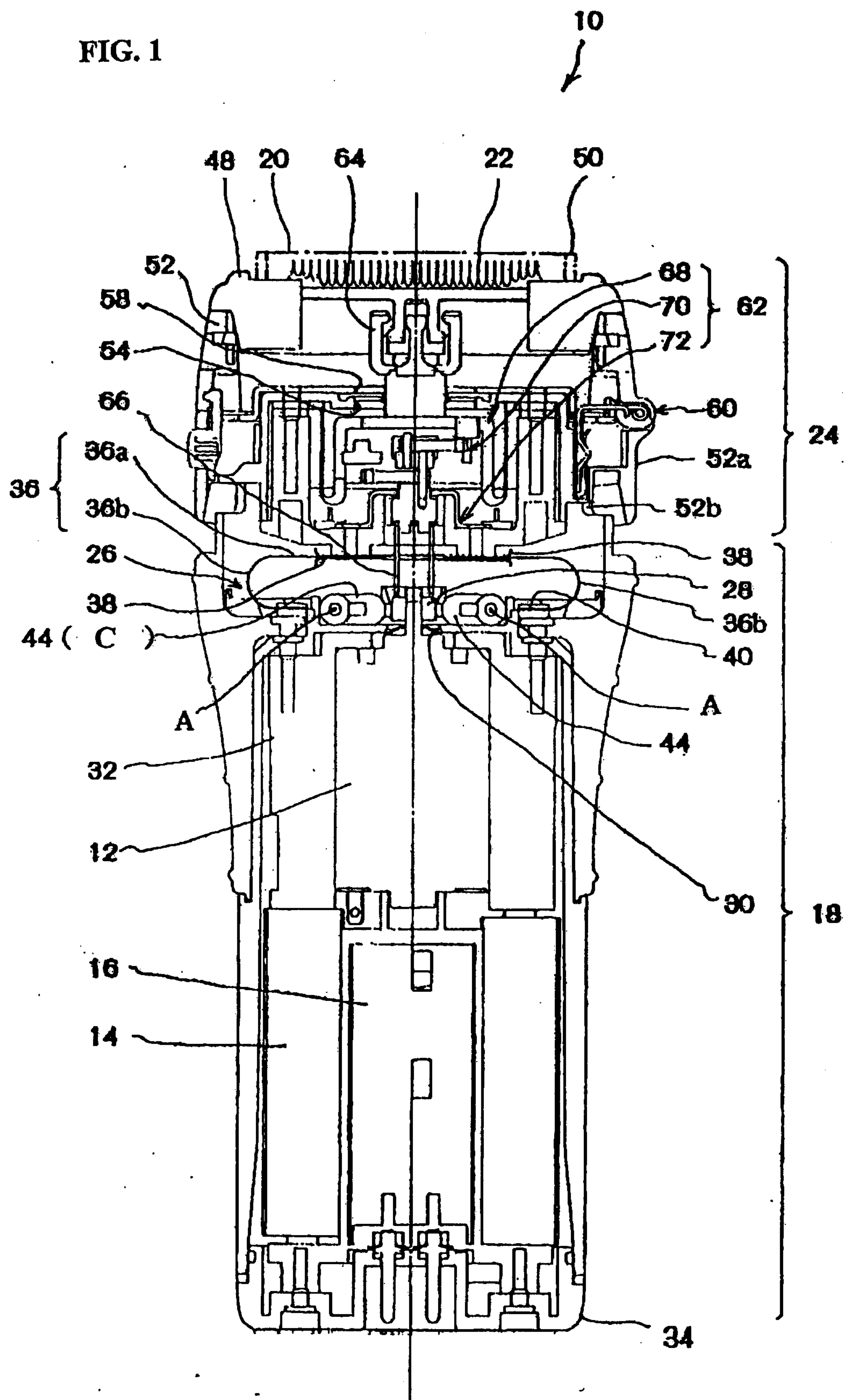


FIG. 2

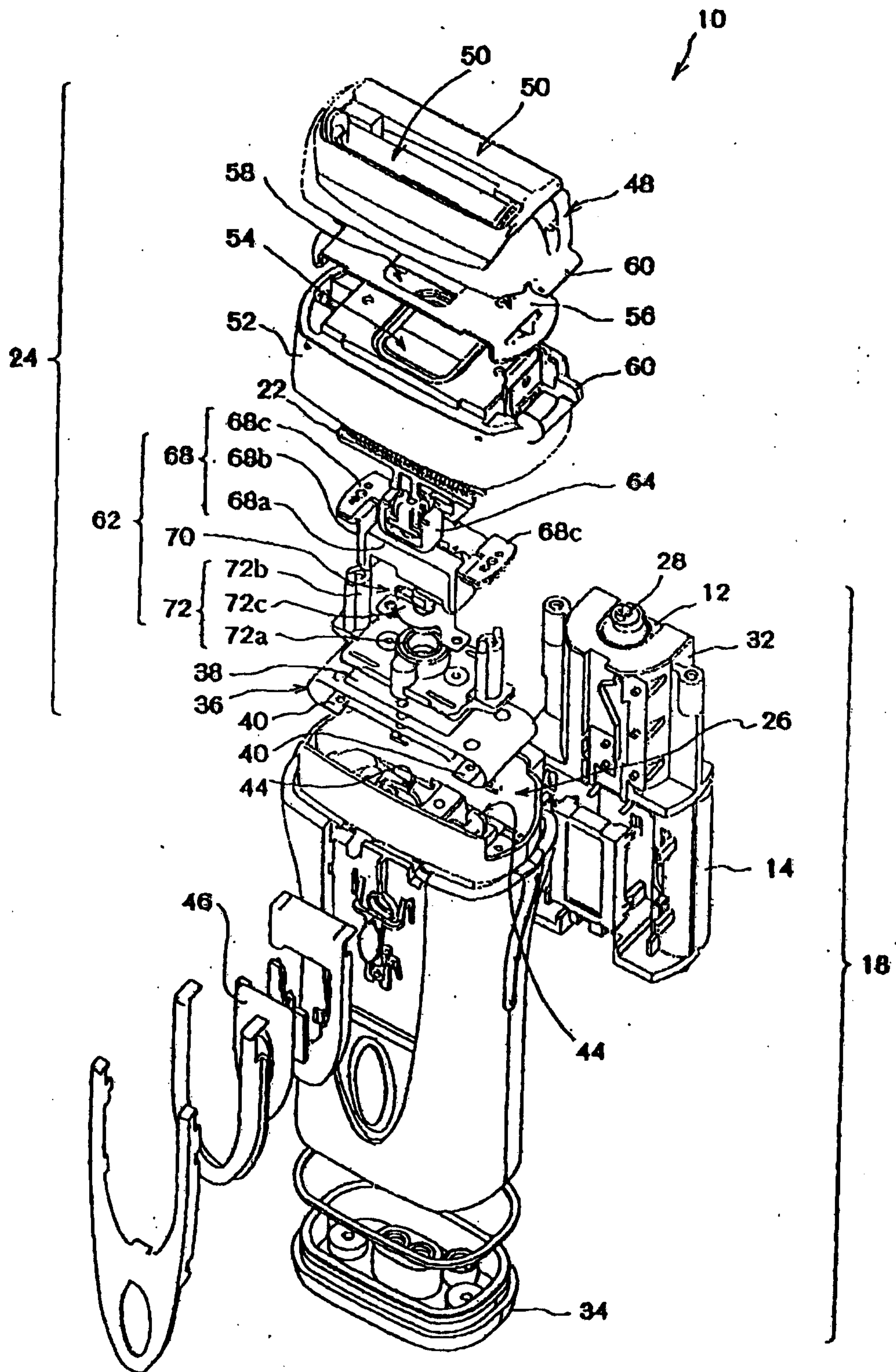


FIG. 3

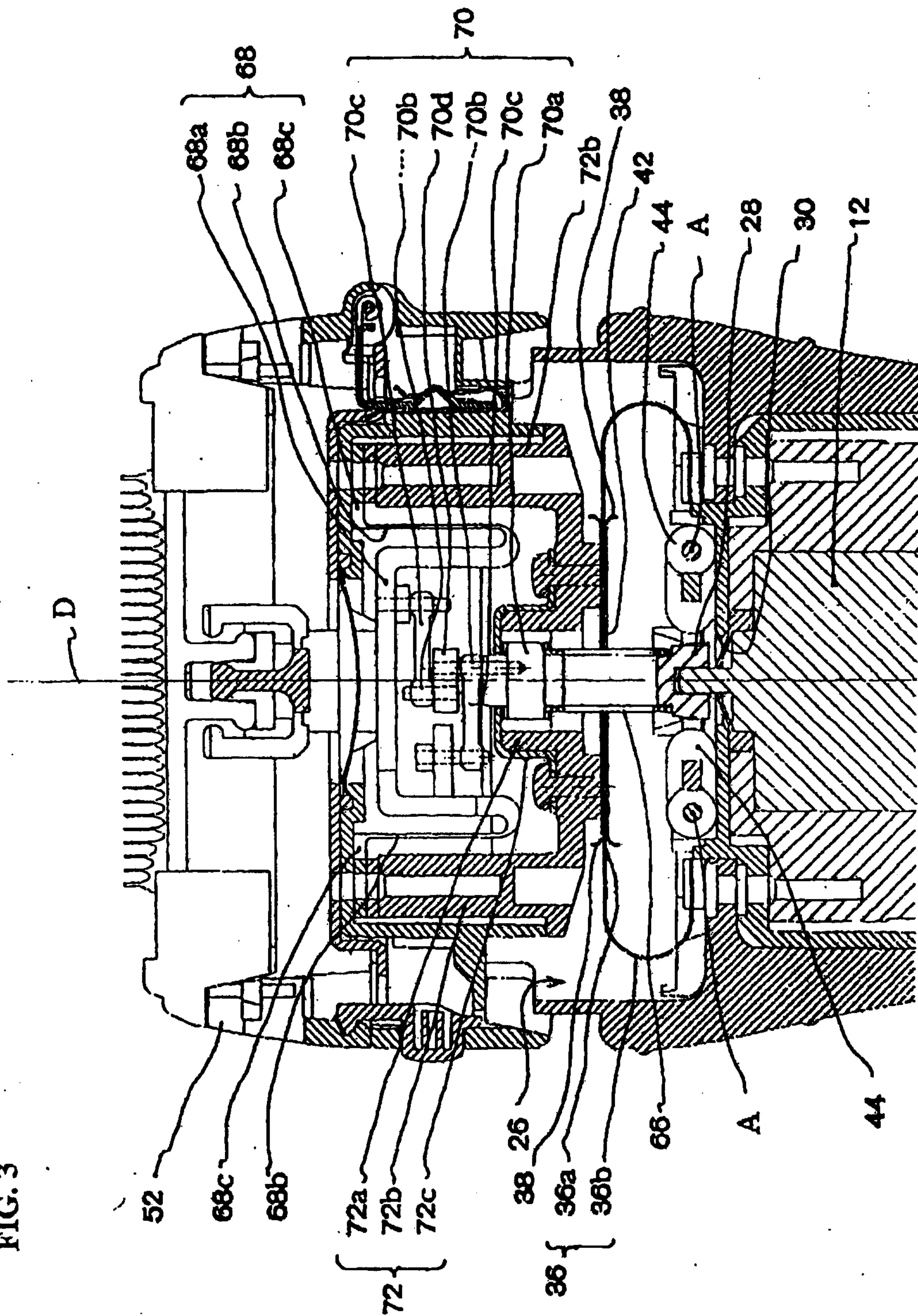


FIG. 4

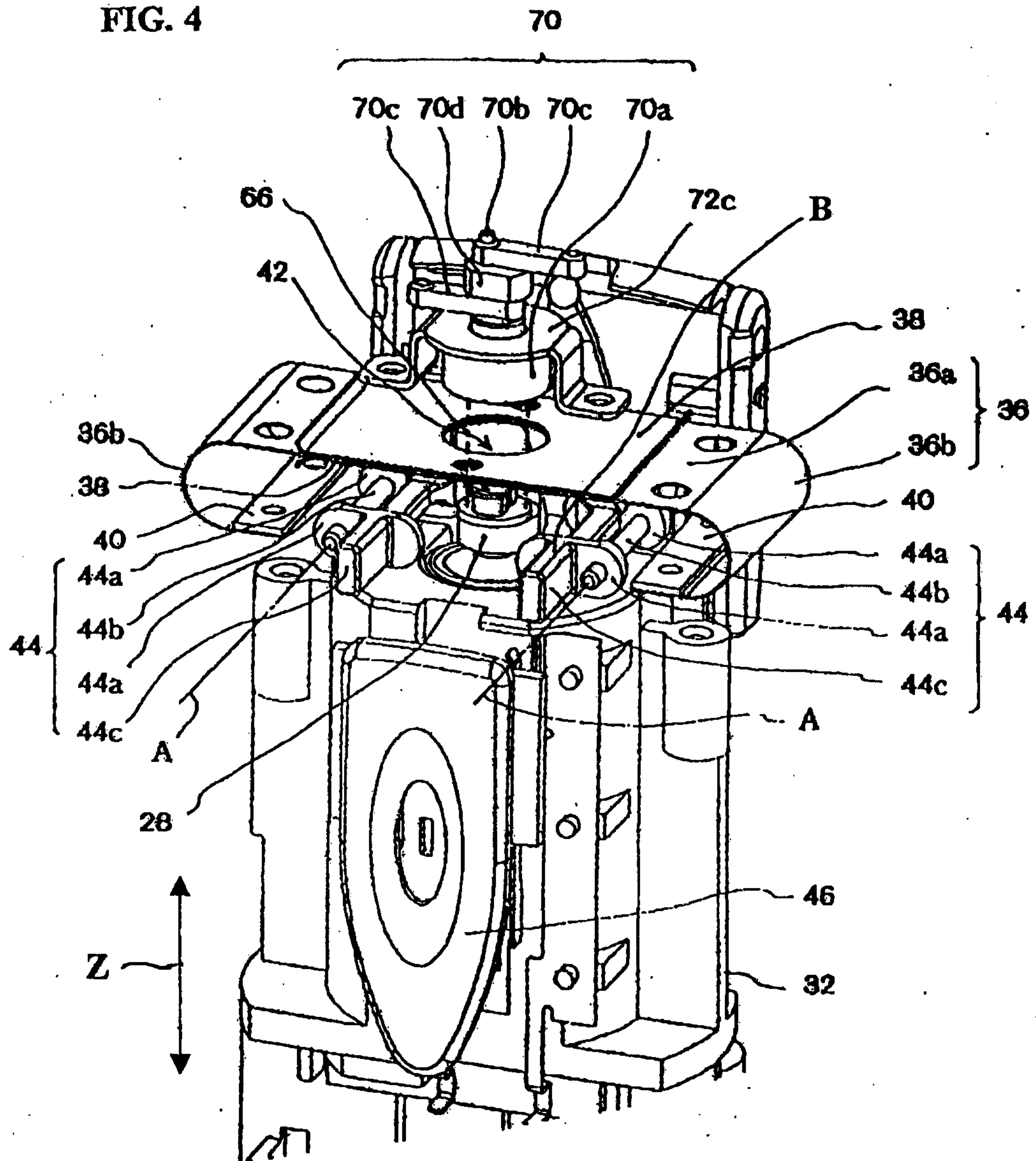


FIG. 5

