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ELECTRIC HAIR CUTTING DEVICE WITH INERTIAL LOADING COMPENSATION

Abstract

A hair clipper with inertial load compensation includes a housing having a first end and a second end opposite the first end, a bladeset mounted to the housing at the first end. The bladeset includes a stationary blade, a moving blade movable relative to the stationary blade along a cutting axis in first and second directions to produce a cutting action, a cam follower mounted to the moving blade, and a tensioner in contact with the cam follower and arranged to bias the cam follower into engagement with the moving blade. One or more compensation elements contact the cam follower and are arranged to bias the cam follower in a direction parallel to the cutting axis.

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Background/Summary

RELATED APPLICATION [0001] The present application claims the benefit under 35 USC 119 (e) of U.S. Provisional Application No. 63/552,815 filed Feb. 13, 2024, the entire contents of which are incorporated by reference herein.

BACKGROUND

[0002] The present invention relates generally to electric hair cutting devices such as hair clippers and hair trimmers, and more specifically to mechanical systems associated with the reciprocating blades of such hair clippers and trimmers.

[0003] Electric hair cutting devices include a moving blade that laterally reciprocates in relation to a stationary blade to perform a cutting action. Both the moving blade and the stationary blade have teeth, and both blades are collectively referred to as the clipper bladeset. Hair caught between the teeth of the blades is sheared through movement of the moving blade relative to the stationary blade.

[0004] Contemporary electric hair cutting devices also include an electric motor that is powered by an on-board battery, and/or via a supply voltage from an outlet. The motor is mechanically coupled to the moving blade to produce the reciprocation of the moving blade via one of a variety of different mechanical linkage formats (e.g. eccentric cam arrangements, pivot arm arrangements, etc.).

[0005] It is desirable for the motor to reciprocate the moving blade as fast as possible as this leads to the most efficient hair cutting. However, higher speeds lead to higher power requirements, excessive wear on the mechanical system of the electric hair cutting device, and an undesirable temperature increase in the stationary blade which is in contact with the user's skin. As such, electric hair cutting devices are typically designed to run at a speed sufficient to provide a cutting action, but also to avoid the problems of higher speeds noted above.

[0006] In general, there are two primary forces which work against a driving force produced by the motor of the electric hair cutting device, namely, the inertial loading of the moving blade itself and the sliding frictional force between the moving blade and the stationary blade. The effects of these forces increase as speed increases, and hence lead to the above-mentioned increases in power consumption, wear, and blade temperature increases.

[0007] Inertial forces are largely dependent on the mass of the moving blade. While some attempts have been made to use lighter materials or different geometries to reduce mass, these solutions can affect the overall service life of the moving blade, the sharpness of its teeth, etc. In sum, it is not possible to reduce the mass of the moving blade to zero, and as such, inertial loading will always be present.

[0008] Frictional forces can also be reduced, but the very design of hair clippers and trimmers require that the moving blade be held in surface contact with the stationary blade, thereby making friction inherent in the design and a necessary drawback. Similar to mass in inertial loading, it is not possible to reduce friction to zero, and as such, frictional forces will always be present.

[0009] Accordingly, there is a need for an improved electric hair cutting device which includes a mechanical configuration that compensates for inertial and/or frictional loading, to allow the electric hair cutting device to run at higher speeds but with a reduction or elimination of the drawbacks mentioned above.

SUMMARY

[0010] The above-listed need is met or exceeded by an electric hair cutting device having provisions for reducing or eliminating inertial loads created by the moving blade during operation. An embodiment of such an electric hair cutting device includes a housing having a first end and a second end opposite the first end. A bladeset is mounted to the housing at the first end. The bladeset

includes a stationary blade and a moving blade. The moving blade is movable relative to the stationary blade along a cutting axis in first and second directions to produce a cutting action.
[0011] The bladeset also includes a cam follower mounted to the moving blade and a tensioner. The tensioner is in contact with the cam follower and arranged to bias the cam follower into engagement with the moving blade. At least one compensation element contacts the cam follower and is arranged to bias the cam follower in a direction parallel to the cutting axis.
[0012] The at least one compensation element may include a first compensation element and a second compensation element, and in such a configuration, the first and second compensation elements may be arranged in an opposed spaced relationship.
[0013] In an embodiment, the cam follower includes a base portion and a cam receiving portion extending upwardly from the base portion. The tensioner includes a pair of spring arms respectively received in a pair of spring receiving structures formed on the base portion of the cam follower. The at least one compensation element contacts at least one compensation element receiving structure formed on the cam receiving portion of the cam follower.
[0014] In an embodiment including first and second compensation elements, the first and second compensation elements may contact opposing sides of a cam receiving portion of the cam follower, respectively. The first compensation element is received by a first compensation element receiving structure of the cam follower. The second compensation element is received by a second compensation element receiving structure of the cam follower.
[0015] A spring force stored by the first compensation element increases and a spring force stored by the second compensation element decreases when the moving blade moves in the first direction. The spring force stored by the first compensation element decreases and the spring force stored by the second compensation element increases when the moving blade moves in the second direction.
[0016] In an embodiment, the at least one compensation element may be a compression spring. However, it is contemplated that any mechanical expedient which functions according to Hooke's Law may be employed as the at least one compensation element.
[0017] The above listed need is also met or exceeded by an electric hair cutting device having dual biasing elements acting on a cam follower along differing directions. An embodiment of such an electric hair cutting device includes a housing having a first end and a second end opposite the first end. A bladeset is mounted to the housing at the first end. The bladeset includes a stationary blade and a moving blade. The moving blade is movable relative to the stationary blade along a cutting axis.
[0018] A cam follower is mounted to the moving blade. The cam follower includes a pair of spring receiving structures and at least one compensation element receiving structure. The bladeset also includes tensioner including a pair of spring arms respectively received in the pair of first spring receiving structures. At least one compensation element is received by the at least one compensation element receiving structure.
[0019] In an embodiment, the at least one compensation element has a first end and a second end. The second end is movable relative to the first end. The second end is received by the at least one compensation element receiving structure. The first end is fixedly mounted to a mounting structure within the housing. The mounting structure may be formed on a blade guide mounted to the housing.
[0020] In an embodiment, the at least one compensation element may include a first compensation element and a second compensation element in an opposed spaced relation. The at least one compensation element receiving structure includes a first compensation element receiving structure, and a second compensation element receiving structure. The first and second compensation elements may be compression springs.
[0021] In an embodiment, the cam follower includes a base portion and a cam receiving portion extending upwardly from the base portion. The first and second compensation element receiving structures are formed on the cam receiving structure. The pair of spring receiving structures are

formed on the base portion of the cam follower.
[0022] Other aspects, objectives and advantages of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0023] The accompanying drawings incorporated in and forming a part of the specification illustrate several aspects of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings:
[0024] FIG. **1** is a top perspective view of an exemplary embodiment of an electric hair cutting device constructed according to the teachings herein;
[0025] FIG. **2** is a partial side cross section of the electric hair cutting device of FIG. **1** taken along the line **2-2** and in the direction generally indicated;
[0026] FIG. **3** is a perspective view of a bladeset of the electric hair cutting device of FIG. **1**, associated with a portion of the remainder of the electric hair cutting device;
[0027] FIG. **4** is a perspective view of the cam follower of the bladeset of FIG. **3**;
[0028] FIGS. **5-7** are front views of an assembly of the cam follower of FIG. **4** with the remainder of the electric hair cutting device;
[0029] FIG. **8** is a free body diagram of a moving blade of the electric hair cutting device of FIG. **1**; and
[0030] FIG. **9** is graph illustrating the inertial loading on the moving blade of FIG. **8**.
[0031] While the invention will be described in connection with certain preferred embodiments, there is no intent to limit it to those embodiments. On the contrary, the intent is to cover all alternatives, modifications and equivalents as included within the spirit and scope of the invention as defined by the appended claims.
DETAILED DESCRIPTION
[0032] Turning now to the drawings, FIG. **1** illustrates an exemplary embodiment of an electric hair cutting device embodied herein for non-limiting example as a hair clipper **20**. Hair clipper **20** includes a housing **22** having a first end and a second end. A bladeset **24** is mounted at the first end. Bladeset **24** includes a moving blade **26** which moves relative to a stationary blade **28** to produce a hair cutting action. While the following description will be provided in the context of a hair clipper of the type shown in FIG. **1**, the invention is not limited to the device illustrated, and it is envisioned that the teachings herein may be readily applied to other devices such as hair trimmers, or any electric hair cutting device having a reciprocating blade.
[0033] Hair trimmer **20** includes an internal electric motor **30** powered via a power source **32**. It will be recognized from the description herein that the invention is not constrained to a particular power source or a particular motor type. For example, power source **32** may be embodied by an internal battery carried by housing **22** or may be an external power source such as a supply voltage provided by a wall outlet.
[0034] A mechanical linkage (not shown) connects motor **30** to bladeset **24** to induce a reciprocating motion to moving blade **26** relative to stationary blade **28** to provide a cutting action. More specifically, moving blade **26** is operable to reciprocate in first and second directions **36**, **38** along a cutting axis **40**. Cutting axis **40** is defined generally at the line defined by the tips of a plurality of moving teeth **46** of moving blade **26** as located relative to a plurality of stationary teeth **48** of stationary blade **28**.
[0035] Hair clipper **20** also includes an adjustment mechanism **34** for adjusting a relative distance between the tips of the teeth of moving blade **26** and the tips of the teeth of stationary blade **28**. In the illustrated embodiment, adjustment mechanism **34** moves stationary blade **28** relative to

moving blade **26** along a longitudinal axis **42** of hair clipper **20**.

[0036] Turning now to FIG. **2**, stationary blade **28** is mounted to a portion of adjustment mechanism **34** with one or more fasteners **44**. Stationary teeth **48** form a leading end of stationary blade **28** as shown. Moving blade **26** is positioned above stationary blade **28** and held against stationary blade **28** via a spring force provided by a tensioner **50**. Like stationary blade **28**, a plurality of moving teeth **46** form a leading end of moving blade **26**.

[0037] Tensioner **50** is illustrated as a spring but may be embodied as any mechanical expedient operable to bias moving blade **26** into contact with stationary blade **28** such that moving blade **26** does not come out of sliding contact with stationary blade **28** during operation. Tensioner **50** includes a retainer portion **58** and one or more spring arms **60**. Retainer portion **58** is mounted to housing **22**, and spring arms **60** extend outwardly and exert a force against a cam follower **52**.

[0038] Cam follower **52** is in turn coupled to moving blade **26**. Cam follower **52** is operably connected to the above-introduced mechanical linkage (not shown) between motor **30** (see FIG. **1**) and cam follower **52**. In an instance where motor **30** is embodied by a rotary motor and where the mechanical linkage is an eccentric cam, cam follower **52** engages this cam to convert the rotary motion of the cam into a linear reciprocating motion.

[0039] Cam follower **52** is connected to moving blade **26** such that it does not move relative to moving blade **26**. In the illustrated embodiment, this connection is achieved via an extension of a projection **54** of cam follower **52** into a similarly shaped opening **56** of moving blade **26**. Those of skill in the art will readily appreciate that the configuration of connection between moving blade **26** and cam follower **52** may be readily changed to adapt to different blade and cam follower designs.

[0040] Cam follower **52** includes a linear guide rail **62** that is received in a corresponding linear guide channel **64** of a blade guide **70** of hair clipper **20**. Guide rail **62** is constrained to a linear motion within guide channel **64** in the manner described for example in U.S. Pat. No. 9,144,911 to Arndt et al. titled Linear Drive System for Hair Clippers, the disclosure of which is incorporated by reference herein in its entirety.

[0041] Blade guide **70** is illustrated as a separate component mounted to housing **22** via fasteners **72**. However, it is also contemplated that blade guide **70** may be integrally formed with housing **22**. In general, blade guide **70** may take the form of any construction capable of constraining moving blade **26** to a linear reciprocating motion relative to stationary blade **28**.

[0042] At least one compensation element is mounted between blade guide **70** and cam follower **52**, and in the illustrated embodiment, first and second compensation elements **82**, **84** are utilized (see also FIG. **3**). In other embodiments, a single compensation element may be employed. A force balance benefit arises by including opposed first and second compensation elements, **82**, **84**, but in any case, a single compensation element could also be employed. As will be described in greater detail below, first and second compensation elements **82**, **84** exert a compensation force against cam follower **52** during the reciprocation of cam follower **52**. This compensation force serves to reduce or in some cases entirely cancel the inertial forces resulting from the acceleration of moving blade **26** and the componentry which moves therewith during operation.

[0043] In the illustrated embodiment, first and second compensation elements **82**, **84** are compression springs, however, first and second compensation elements **82**, **84** may take the form of any structure that provides a reactionary force to the movement of moving blade **26**. In the illustrated embodiment using compression springs, this reactionary force may be defined according to Hooke's Law. As one alternative example to a compression spring, however, first and second compensation elements **82**, **84** may be embodied as viscoelastic devices. As another alternative example, first and second compensation elements **82**, **84** may be embodied as a viscoelastic medium.

[0044] With reference to FIG. **3**, first and second compensation elements **82**, **84** are arranged such that they act on opposing sides of cam follower **52** and exert forces thereon in directions parallel to the cutting axis **40** (see FIG. **1**). In the illustrated embodiment, compensation elements **82**, **84** are identical and are symmetrically arranged relative to a mid-plane of cam follower **52**. In particular, first and second compensation elements **82**, **84** act on opposing sides of a cam receiving portion **92** extending upwardly from base portion **94** of cam follower **52**. In the illustration shown in FIG. **3**, cam follower is at an effective zero or midpoint of its stroke. At this location, each of first and second compensation elements **82**, **84** exert equal and opposite forces against cam receiving portion **92**.

[0045] As a result of this symmetrical arrangement about cam receiving portion **92**, and when moving blade **26** and cam follower reciprocate along cutting axis **40** (see FIG. **1**) in first and second cutting directions **36**, **38**, energy is reciprocally stored and discharged by first and second compensation elements **82**, **84**. For example, when moving blade **26** and cam follower **52** move in first cutting direction **36** (see FIG. **1**), first compensation element **82** is compressed, and thereby the spring force stored thereby is increased.

[0046] Likewise, when moving blade **26** and cam follower **52** move in second cutting direction **38** (see FIG. **1**), first compensation element **82** lengthens by exerting a spring force against cam follower **52**, while second compensation element **84** is compressed to thereby store energy, all according to Hooke's Law. This cycle repeats itself as moving blade **26** and cam follower **52** reciprocate in first and second cutting directions **36**, **38** because of the above introduced eccentric cam (not shown) rotating within a cam slot **98** of cam follower **52**.

[0047] A first end of each of first and second compensation elements **82**, **84** is received on corresponding post-like mounting structures **90** formed on blade guide **70**. It is also contemplated, however, that mounting structures **90** may be formed directly on an interior of housing **22** and may take any form necessary to receive the first ends of first and second compensation elements **82**, **84** to allow the motion of first and second compensation elements **82**, **84** as described herein. A second end opposite the first end of each of first and second compensation elements **82**, **84** is received on cam receiving portion **92**. It is also contemplated first and second compensation elements **82**, **84** may directly contact moving blade **26** or any structure fixed relative thereto.

[0048] Still referring to FIG. **3**, spring arms **60** are received in a pair of spring receiving structures **102**. Spring receiving structures **102** are formed on base portion **94** of cam follower **52**. In the illustrated embodiment, spring receiving structures **102** are generally ramped depressions. However, they may take any form necessary to receive spring arms **60** to allow the functionality thereof as described herein.

[0049] With reference now to FIG. **4**, a pair of compensation element receiving structures **104** are formed on cam receiving portion **92** of cam follower **52**. Compensation element receiving structures **104** are ramped projections sized to be received within the inner diameter of each of first and second compensation elements **82**, **84** (see also FIG. **3**). Cam receiving portion **92** converges to a tip **110** as shown. The ramped sides of tip **110** generally align with the ramped faces of compensation element receiving structures **104** to form generally continuous ramped surfaces on either side of cam receiving portion **92**. A ramped tab **112** for retaining cam follower **92** on blade guide **70** (see FIG. **7**) is also provided on cam receiving portion **92**. As will be explained relative to FIGS. **5-7**, these ramped surfaces facilitate the assembly cam follower **52** when assembling hair clipper **20**.

[0050] Indeed, and with reference to FIG. **5**, as cam follower **52** is inserted into blade guide **70** in direction **114** as shown, tip **110** will begin to spread first and second compensation elements **82**, **84** apart and the ends thereof will begin to slide along the ramped opposing surfaces of cam receiving portion **92** of cam follower **52**. As shown in FIG. **6**, continued movement of cam follower **52** in direction **114** will continue to spread first and second compensation elements **82**, **84** apart. As shown in FIG. **7**, continued movement of cam follower **52** in direction **114** will ultimately seat first and second compensation elements **82**, **84** on their corresponding compensation element receiving structures **104** and seat tab **112** on an upper surface **116** of guide channel **64**. As such, cam follower **52** is self-centering during installation as a result of the aforementioned ramped surfaces on the compensation element receiving structures **104**.

[0051] FIG. **8** illustrates a schematic free body diagram of moving blade **26** at a point in which it has completed its movement in first direction **36** and is beginning to move back in second direction **38**. A driving force FD is imparted to moving blade **26** from motor **30** (see FIG. **1**) in general at the point of contact CD between the above discussed eccentric cam (not shown) and cam follower **52** (see FIG. **3**). Point CD is spaced a distance D**1** from a center of mass CM of moving blade **26**. A resultant frictional force FF from the frictional contact surfaces between moving blade **26** and stationary blade **28** (see FIG. **1**) and all other frictional contact surfaces resulting from the reciprocation of moving blade **26** also acts on the center of mass CM. A resultant inertial force FI resulting from the inertia of moving blade **26** and cam follower **52** also act on the center of mass CM.

[0052] Opposing forces FC**1**, FC**2** applied by first and second compensation elements **82**, **84** (see FIG. **3**) act at a point CP spaced a distance D**2** from the center of mass CM. Point CP represents the point at which first and second compensation elements **82**, **84** contact cam receiving portion **92** of cam follower **52** (see FIG. **3**). Opposing reactionary forces FR**1**, FR**2** act along a line generally representing the contact of guide rail **62** and guide channel **64** (see FIG. **2**) as a reaction to the moment about the center of mass CM caused by the driving force FD and compensation forces FC**1**, FC**2**.

[0053] As may be surmised by inspection of FIG. **8**, if distance D**2** is minimized or reduced to zero, FC**1** and FC**2** will not produce a moment about the center of mass CM, and hence will not increase the reactionary forces FR**1**, FR**2**, thereby reducing wear at these points of contact. It is contemplated herein that point CP may be situated directly linearly above the center of mass CM by arranging the location of where first and second compensation elements **82**, **84** act on cam follower **52** to eliminate any moment about the center of mass CM caused by FC**1**, FC**2**.

[0054] At the point in the stroke of moving blade **26** shown in FIG. **8**, and referring also to FIG. **3**, first compensation element **82** has stored a force FC**1** greater than the force FC**2** exerted by second compensation element **84**. Indeed, at the stroke midpoint generally illustrated in FIG. **3**, each of first and second compensation elements **82**, **84** have been compressed to some extent, but in this equilibrium position, each compensation element forces FC**1** and FC**2** are equal and opposite. As moving blade **26** moves in first cutting direction **36**, first compensation element **82** is shortened, and the spring force is increased according to Hooke's Law as the product of the change in length of first compensation element **82** and the spring constant k of first compensation element **82**. As this occurs, second compensation element **84** is lengthened, such that it first achieves its free length and then displaces an additional value to lengthen beyond its free length. This continues until movement in the first cutting direction **36** stops.

[0055] The change in length of first compensation element **82** relative to its free length is greater than the change in length of the second compensation element **84** relative to its free length, and hence FC**1** is greater than FC**2** at the end of the stroke. This reverses as moving blade **26** moves in second cutting direction **38**. The forces FC**1** and FC**2** act primarily to offset or entirely eliminate the inertial forces FI and frictional forces FF acting on the center of mass CM. These compensation forces FC**1**, FC**2** can be tuned by selecting appropriate spring constants k for each of first and second compensation elements **82**, **84**.

[0056] FIG. **9** illustrates two plots **120**, **122** of the inertial forces acting on moving blade **26**. Plot **120** illustrates a system that does not employ a compensation element as described herein. As may be seen from this plot, inertial forces increase over time to a constant sinusoidal amplitude over time. Plot **122** illustrates a system represented by the embodiment illustrated herein. As may be seen, the inertial forces generally decrease over time to a minimal constant, and near zero, value. A reduction in the inertial loads has the advantage of allowing higher speeds without the increased impact of increased wear and heat.

[0057] All references, including publications, patent applications, and patents cited herein are

hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.
[0058] The terms “hair clipper” and “hair trimmer” are used interchangeably unless otherwise noted, and do not limit the scope or applicability of the invention herein to either particular variant.
[0059] The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) is to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms “comprising,” “having,” “including,” and “containing” are to be construed as open-ended terms (i.e., meaning “including, but not limited to,”) unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., “such as”) provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.
[0060] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

Claims

1. An electric hair cutting device, comprising: a housing having a first end and a second end opposite the first end; a bladeset mounted to the housing at the first end, the bladeset comprising: a stationary blade; a moving blade movable relative to the stationary blade along a cutting axis in first and second directions to produce a cutting action; a cam follower mounted to the moving blade; and a tensioner in contact with the cam follower and arranged to bias the cam follower into engagement with the moving blade; at least one compensation element in contact with the cam follower and arranged to bias the cam follower in a direction parallel to the cutting axis.
2. The electric hair cutting device of claim 1, wherein the at least one compensation element includes a first compensation element and a second compensation element, the first and second compensation elements arranged in an opposed spaced relationship.
3. The electric hair cutting device of claim 1, wherein the cam follower includes a base portion and a cam receiving portion extending upwardly from the base portion.
4. The electric hair cutting device of claim 3, wherein the tensioner contacts the base portion, and wherein the at least one compensation element contacts the cam receiving portion.
5. The electric hair cutting device of claim 4, wherein the tensioner includes a pair of spring arms respectively received in a pair of spring receiving structures formed on the base portion of the cam follower.
6. The electric hair cutting device of claim 4, wherein the at least one compensation element contacts at least one compensation element receiving structure formed on the cam receiving portion of the cam follower.

7. The electric hair cutting device of claim 2, wherein the first and second compensation elements contact opposing sides of a cam receiving portion of the cam follower, respectively.
8. The electric hair cutting device of claim 7, wherein the first compensation element is received by a first compensation element receiving structure of the cam follower, and wherein the second compensation element is received by a second compensation element receiving structure of the cam follower.
9. The electric hair cutting device of claim 8, wherein a spring force stored by the first compensation element increases and a spring force stored by the second compensation element decreases when the moving blade moves in the first direction.
10. The electric hair cutting device of claim 9, wherein the spring force stored by the first compensation element decreases and the spring force stored by the second compensation element increases when the moving blade moves in the second direction.
11. The electric hair cutting device of claim 1, wherein the at least one compensation element is a compression spring.
12. An electric hair cutting device, comprising: a housing having a first end and a second end opposite the first end; a bladeset mounted to the housing at the first end, the bladeset comprising: a stationary blade; a moving blade movable relative to the stationary blade along a cutting axis; a cam follower mounted to the moving blade, the cam follower including a pair of spring receiving structures and at least one compensation element receiving structure; and a tensioner including a pair of spring arms respectively received in the pair of first spring receiving structures; at least one compensation element received by the at least one compensation element receiving structure.
13. The electric hair cutting device of claim 12, wherein the at least one compensation element has a first end and a second end, the second end movable relative to the first end, the second end received by the at least one compensation element receiving structure.
14. The electric hair cutting device of claim 13, wherein the first end is fixedly mounted to a mounting structure within the housing.
15. The electric hair cutting device of claim 14, wherein the mounting structure is formed on a blade guide mounted to the housing.
16. The electric hair cutting device of claim 12, wherein the at least one compensation element includes a first compensation element and a second compensation element in an opposed spaced relation, and wherein the at least one compensation element receiving structure includes a first compensation element receiving structure, and a second compensation element receiving structure.
17. The electric hair cutting device of claim 16, wherein the first and second compensation elements are compression springs.
18. The electric hair cutting device of claim 16, wherein the cam follower includes a base portion and a cam receiving portion extending upwardly from the base portion.
19. The electric hair cutting device of claim 18, wherein the first and second compensation element receiving structures are formed on the cam receiving structure.
20. The electric hair cutting device of claim 19, wherein the pair of spring receiving structures are formed on the base portion of the cam follower.