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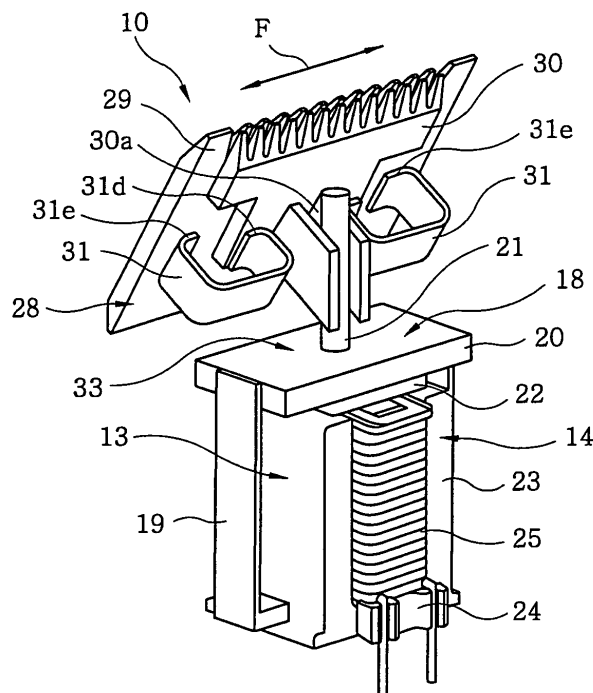
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(54) **Hair clipper**

(57) A hair clipper 10 is adapted to vibrate a comb-shaped movable blade 30 with a vibratory linear actuator 12 in a state that the comb-shaped movable blade 30 is pressed against a comb-shaped fixed blade 29 by means of spring members 31. The spring members 31 also serve as a resonance spring for resonating the movable blade 30 in the reciprocating movement directions "F" and it is possible to independently adjust a spring force compo-

nent "H" acting to press the movable blade 30 against the fixed blade 29 and a spring force component "I" acting to resonate the movable blade 30 in the reciprocating movement directions "F". Thus, by increasing the spring force component "H" acting to press the movable blade 30 against the fixed blade 29, it is possible to improve a cutting performance of the hair clipper 10 while reducing the size thereof.

FIG. 2A



Description

[0001] The present invention relates to a hair clipper provided with a vibratory linear actuator.

[0002] Japanese Laid-open Patent Publication No. H10-94684 discloses a conventional reciprocating type electric shaver provided with a vibratory linear actuator, e.g., a linear motor.

[0003] The reciprocating electric shaver is designed to vibrate a movable blade with the vibratory linear actuator in a state that the movable blade (inner blade) is pressed against a fixed blade (net-shaped outer blade) by means of a spring member.

[0004] In the meantime, as shown in Figs. 6A, 6B and 7, it would be conceivable that a hair clipper employs a vibratory linear actuator 2 to vibrate a comb-shaped movable blade 3 in the directions indicated by the arrow "F" in a state that the comb-shaped movable blade 3 is pressed against a comb-shaped fixed blade 4 by means of spring members 5. The configurations of the vibratory linear actuator 2 and the other parts will be described in detail in the section of Detailed Description of the Embodiments.

[0005] In an effort to reduce a size of the hair clipper, the spring members 5 are designed to serve as both a thrust spring for pressing the movable blade 3 against the fixed blade 4 and a resonance spring for resonating (moving) the movable blade 3 in the reciprocating directions "F".

[0006] In the hair clipper described above, a coil spring is used as the spring members 5. Thus, if a spring force component "H" acting to press the movable blade 3 against the fixed blade 4 is increased by changing the arrangement of the spring members 5 from the state illustrated in Fig. 8A to the state depicted in Fig. 8B, the height of a blade block of the hair clipper 1 (including the movable blade 3, the fixed blade 4 and the spring member 5) is increased. Furthermore, in the hair clipper, the spring members 5 need to be arranged closer to a blade edge, so that a surrounding structure of the blade edge increases in size, thereby making the manipulation of the hair clipper difficult.

[0007] Moreover, if a spring force component "I" acting to resonate the movable blade 3 is increased by changing the arrangement of the spring members 5 from the state illustrated in Fig. 8A to the state depicted in Fig. 8C, the spring force component "H" acting to press the movable blade 3 against the fixed blade 4 becomes weak. Thus, the movable blade 3 tends to float away from the fixed blade 4 during the operation of the hair clipper, which deteriorates the cutting performance of the hair clipper.

[0008] It is, therefore, an object of the present invention to provide a hair clipper capable of improving the cutting performance thereof and making the manipulation thereof easy while reducing the size thereof.

[0009] In accordance with an aspect of the present invention, there is provided a hair clipper including a comb-shaped fixed blade, a comb-shaped movable blade, and

a vibratory linear actuator for vibrating the movable blade in reciprocating movement directions with respect to the fixed blade in a state that the movable blade is pressed against the fixed blade by means of a spring member, characterized in that: the spring member is configured to have a spring force component acting to press the movable blade against the fixed blade and another spring force component acting to resonate the movable blade in the reciprocating movement directions.

[0010] A torsional moment acting to press the movable blade against the fixed blade is preferably applied to the spring member, so that the cutting performance of the hair clipper is improved while making the manipulation of the hair clipper easy through reduction in size of a surrounding structure of the blade edge.

[0011] Preferably, the spring member is formed into a generally U-shape, both end portions thereof being respectively fixed to the movable blade and the fixed blade; and the spring force component acting to press the movable blade against the fixed blade is adjusted by changing an interior angle of the spring member and the spring force component acting to resonate the movable blade in the reciprocating movement directions is adjusted by changing an effective length or a width of the spring member. In this way, the spring force component acting to press the movable blade against the fixed blade and the spring force component acting to resonate the movable blade in the reciprocating movement directions can be readily adjusted.

[0012] The torsional moment may be applied with ease by twisting an intermediate portion of the spring member between the end portions.

[0013] In accordance with the present invention, the spring members for pressing the movable blade against the fixed blade also serve as a resonance spring for resonating (moving) the movable blade in the reciprocating movement directions and it is possible to independently adjust the spring force component acting to press the movable blade against the fixed blade and the spring force component acting to resonate (move) the movable blade in the reciprocating movement directions. Thus, by increasing the spring force component acting to press the movable blade against the fixed blade, it is possible to improve the cutting performance of the hair clipper while reducing the size thereof.

[0014] Furthermore, the spring force component acting to press the movable blade against the fixed blade can be increased without increasing the height of the blade block of the hair clipper (including the movable blade, the fixed blade and the spring members). Accordingly, even when the spring force component acting to press the movable blade against the fixed blade is increased, there is no need to arrange the spring members closer to a blade edge and a surrounding structure of the blade edge is not increased in size, which keeping the manipulation of the hair clipper easy.

[0015] The above and other objects and features of the present invention will become apparent from the fol-

lowing description of preferred embodiments, given in conjunction with the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of a hair clipper in accordance with an embodiment of the present invention;

Fig. 2A is a perspective view illustrating an assembly of a vibratory linear actuator and a blade block in accordance with the embodiment of the present invention and Fig. 2B is a front elevational view thereof; Fig. 3 is a side view illustrating the vibratory linear actuator and the blade block in accordance with the embodiment of the present invention;

Fig. 4A is a plan view showing a spring member in accordance with the embodiment of the present invention, Fig. 4B is a perspective view thereof, and Fig. 4C is a plan view depicting an elastically deformed state thereof;

Fig. 5A is a side view illustrating a spring member according to a modified embodiment of the present invention in a free state and Fig. 5B is a side view depicting the spring member in a mounted state;

Fig. 6A is a perspective view showing an assembly of a vibratory linear actuator and a blade block employed in a conventional hair clipper and Fig. 6B is a front elevational view thereof;

Fig. 7 is a side view showing the assembly of the vibratory linear actuator and the blade block employed in the conventional hair clipper; and

Figs. 8A, 8B and 8C are front views illustrating various states of the conventional spring members mounted in different ways.

[0016] Hereinafter, an embodiment of the invention will be described in detail with reference to the accompanying drawings.

[0017] Referring to Figs. 1 to 3, a hair clipper 10 includes a generally cylindrical main body housing 11 having a front housing 11A and a rear housing 11B combined together.

[0018] A vibratory linear actuator 13 is received within an upper portion of the main body housing 11, while a battery 15 for power supply and a control circuit 16 for controlling movement of the vibratory linear actuator 13 are accommodated within a lower portion of the main body housing 11.

[0019] The vibratory linear actuator 13 is provided with a movable member 18, a stator core block 14 (stationary member) and retainer members 19.

[0020] The movable member 18 includes a yoke 20 made of a magnetic material, a drive shaft 21 provided upright on the top surface of the yoke 20, and a permanent magnet 22 attached to the bottom surface of the yoke 20.

[0021] The stator core block 14 is formed of an electromagnet including a stator 23 made of a sintered magnetic material or stacked iron plates, and a winding (electric wire) 25 provided in the stator 23 through an insulating

material 24 in an insulated state. The stator core block 14 is fixedly secured in place between the front housing 11A and the rear housing 11B.

[0022] The retainer members 19 are arranged in a pair on the right and left sides and serves to keep the movable member 18 spaced apart from the stator core block 14 so that the permanent magnet 22 of the movable member 18 can be in a face-to-face relationship with the stator core block 14 in a non-contact state with a gap 26 (see Fig. 2B) left therebetween. The retainer members 19 are flexible to allow the movable member 18 to reciprocatingly move in the directions indicated by the arrow "F" in the drawings.

[0023] By alternating the direction of the electric current in the electromagnet, i.e., the stator core block 14, the movable member 18 is reciprocatingly moved together with the permanent magnet 22 in the directions "F".

[0024] A blade block 28 includes a comb-shaped fixed blade 29, a comb-shaped movable blade 30 and spring members 31. The fixed blade 29 is slantingly fixed to a top portion of the rear housing 11B.

[0025] The spring members 31 are arranged in a pair on the right and left sides and are formed by bending a plate spring material of a predetermined width to have a generally U-shape when viewed from the front. As illustrated in Figs. 4A and 4B, each of the spring members 31 is provided at one end portion (first end portion) 31a with an inwardly bent portion 31d which is fixed to the movable blade 30 and at the other end portion (second end portion) 31b with an inwardly bent portion 31e which is secured to the fixed blade 29.

[0026] The spring members 31 are adapted to press the movable blade 30 against the fixed blade 29, while holding the movable blade 30 movable in the reciprocating movement directions "F". In other words, the spring members 31 are adapted to serve as both a thrust spring for pressing the movable blade 30 against the fixed blade 29 and a resonance spring for resonating (moving) the movable blade 30 (exactly, a movable block 33 including the movable blade 30 and the movable member 18) in the reciprocating movement directions "F".

[0027] The movable blade 30 has a coupling portion 30a with a recess for connection with the drive shaft 21 of the movable member 18, and the drive shaft 21 is fitted into the recess of the coupling portion 30a. Thus, as the movable member 18 is vibrated in the directions "F", the movable blade 30 is also vibrated in the directions "F" together with the movable member 18, thereby cutting hairs in cooperation with the fixed blade 29.

[0028] Before being fixed to the movable blade 30 and the fixed blade 29, the spring member 31 has a shape as indicated by the solid line in Fig. 4C. In a state where the spring member 31 is fixed to the movable blade 30 and the fixed blade 29, the spring member 31 is elastically deformed into a shape as indicated by a two-dotted chain line in Fig. 4C. In other words, a spring force component "H" acting to press the movable blade 30 against the fixed blade 29 is generated due to the elasticity of the spring

member 31 which renders an intermediate portion 31c, the first end portion 31a and the second end portion 31b biased toward the movable blade 30.

[0029] The spring force component "H" can be adjusted by changing one of an interior angle θ_1 between the first end portion 31a and the inwardly bent portion 31d, an interior angle θ_2 between the first end portion 31a and the intermediate portion 31c, an interior angle θ_3 between the second end portion 31b and the intermediate portion 31c, and an interior angle θ_4 between the second end portion 31b and the inwardly bent portion 31e.

[0030] Furthermore, a spring force component "I" acting to resonate (move) the movable block 33, including the movable blade 30 and the movable member 18, in the reciprocating movement directions "F" can be adjusted by changing an effective length L or a side surface width W of the spring members 31 (see Fig. 4A).

[0031] Accordingly, the spring members 31 for pressing the movable blade 30 against the fixed blade 29 also serve as a resonance spring for resonating (moving) the movable block 33 including the movable blade 30 and the movable member 18 in the reciprocating movement directions "F", and it becomes possible to independently adjust the spring force component "H" acting to press the movable blade 30 against the fixed blade 29 and the spring force component "I" acting to resonate (move) the movable block 33 in the reciprocating movement directions "F".

[0032] In the hair clipper 10 configured as described above, since the spring members 31 for pressing the movable blade 30 against the fixed blade 29 also serve as a resonance spring for resonating (moving) the movable block 33 including the movable blade 30 and the movable member 18 in the reciprocating movement directions "F" and the spring force component "H" acting to press the movable blade 30 against the fixed blade 29 and the spring force component "I" acting to resonate (move) the movable block 33 in the reciprocating movement direction "F" can be independently adjusted, it is possible to improve the cutting performance of the hair clipper 10 while reducing the size thereof by increasing the spring force component "H" acting to press the movable blade 30 against the fixed blade 29.

[0033] Furthermore, the spring force component "H" acting to press the movable blade 30 against the fixed blade 29 can be increased without increasing the height of the blade block of the hair clipper 10 (including the movable blade 30, the fixed blade 29 and the spring members 31). Accordingly, even when the spring force component "H" is increased, there is no need to arrange the spring members 31 closer to a blade edge and a surrounding structure of the blade edge is not increased in size, which makes the manipulation of the hair clipper easy.

[0034] Moreover, formation of the spring members 31 into a generally U-shape ensures that the spring force component "H" acting to press the movable blade 30 against the fixed blade 29 is readily adjusted by changing

one of the interior angles θ_1 to θ_4 and further that the spring force component "I" acting to resonate (move) the movable block 33 in the reciprocating movement directions "F" is adjusted with ease by changing the effective length L or the side surface width W of the spring members 31.

[0035] As illustrated in Figs. 5A and 5B, a torsional moment acting in the direction indicated by the arrow "E" to press the movable blade 30 against the fixed blade 29 can be applied by twisting the intermediate portion 31c between the first end portion 31a and the second end portion 31b of each of the spring members 31 (in Fig. 5, by twisting the first end portion 31a with respect to the second end portion 31b at an angle θ_5). That is, before being fixed to the movable blade 30 and the fixed blade 29, the spring member 31 has a shape as indicated by the solid line in Fig. 5A. In a state where the spring members 31 are fixed to the movable blade 30 and the fixed blade 29, the spring members 31 is elastically deformed into a shape as indicated by the solid line in Fig. 5B.

[0036] In this way, if the spring members 31 are given the torsional moment acting in the direction "E" to press the movable blade 30 against the fixed blade 29, the force of the spring members 31 pressing the movable blade 30 against the fixed blade 29 is great even when the spring members 31 are disposed spaced apart from the blade edge, as illustrated in Fig. 5B. Thus, it becomes possible to improve the cutting performance of the hair clipper while making the manipulation of the hair clipper easy through reduction in size of a surrounding structure of the blade edge.

[0037] Moreover, a torsional moment can be applied with ease by twisting the spring members 31.

Claims

1. A hair clipper including a comb-shaped fixed blade, a comb-shaped movable blade, and a vibratory linear actuator for vibrating the movable blade in reciprocating movement directions with respect to the fixed blade in a state that the movable blade is pressed against the fixed blade by means of a spring member, **characterized in that:**

the spring member is configured to have a spring force component acting to press the movable blade against the fixed blade and another spring force component acting to resonate the movable blade in the reciprocating movement directions.

2. The hair clipper of claim 1, wherein a torsional moment acting to press the movable blade against the fixed blade is applied to the spring member.
3. The hair clipper of claim 1, wherein the spring member is formed into a generally U-shape, both end portions thereof being respectively fixed to the movable

blade and the fixed blade; and the spring force component acting to press the movable blade against the fixed blade is adjusted by changing an interior angle of the spring member and the spring force component acting to resonate the movable blade in the reciprocating movement directions is adjusted by changing an effective length or a width of the spring member. 5

4. The hair clipper of claim 3, wherein a torsional moment acting to press the movable blade against the fixed blade is applied to the spring member. 10

5. The hair clipper of claim 4, wherein the torsional moment is applied by twisting an intermediate portion of the spring member between the end portions. 15

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FIG. 1

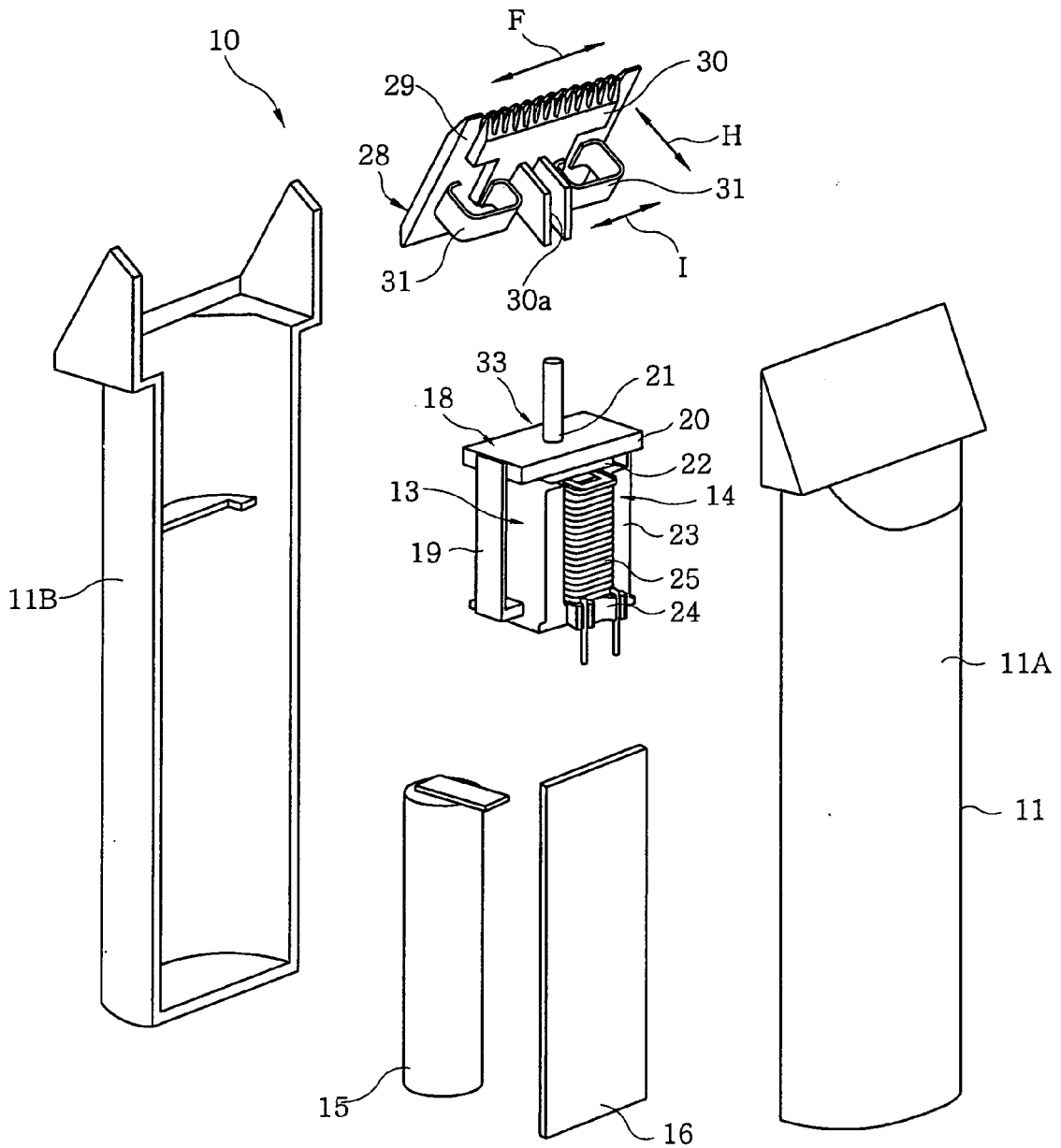


FIG. 2A

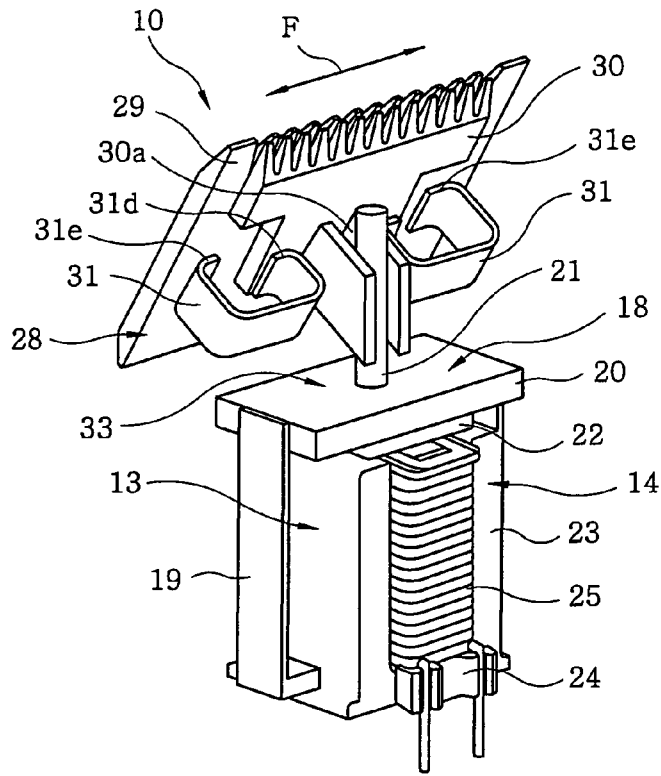


FIG. 2B

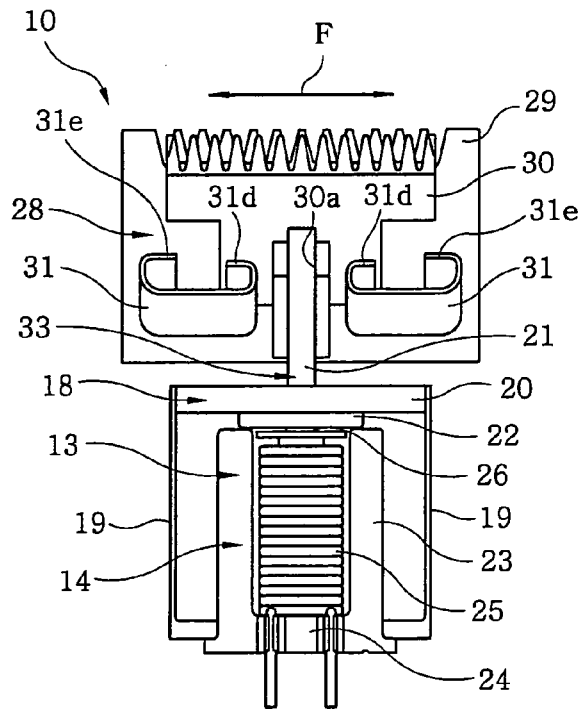


FIG. 3

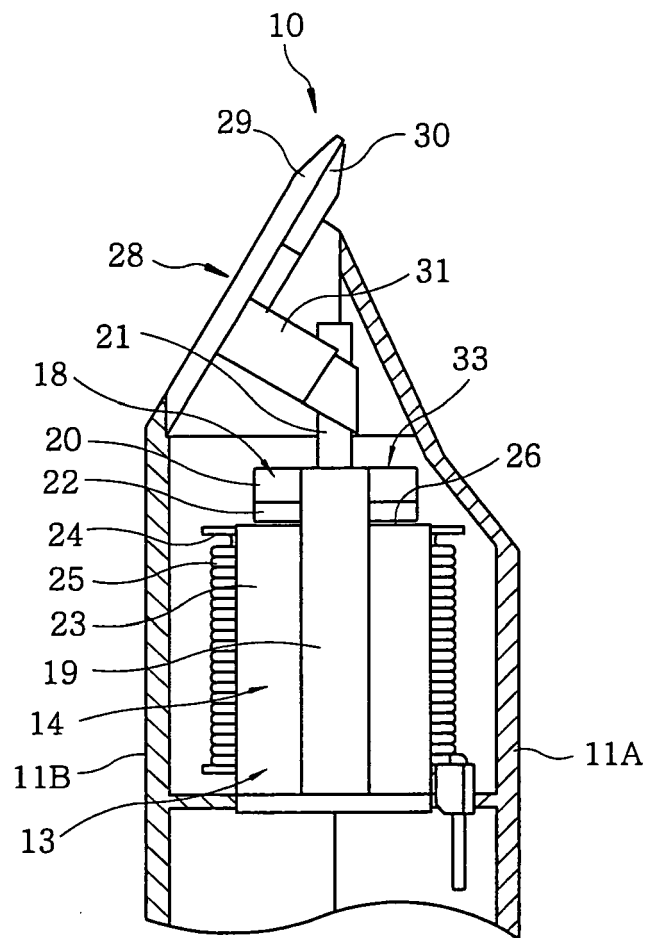


FIG. 4A

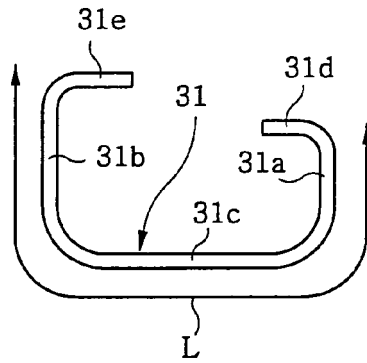


FIG. 4B

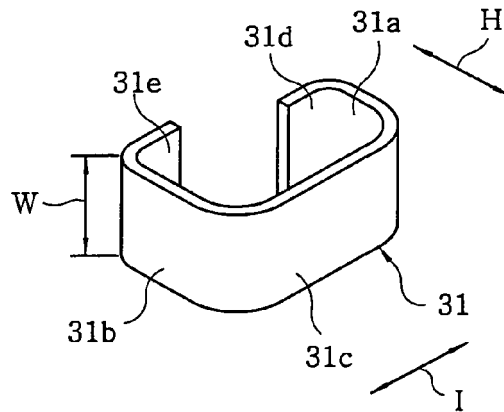


FIG. 4C

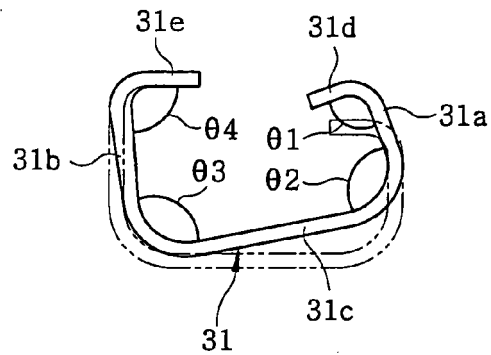


FIG. 5A

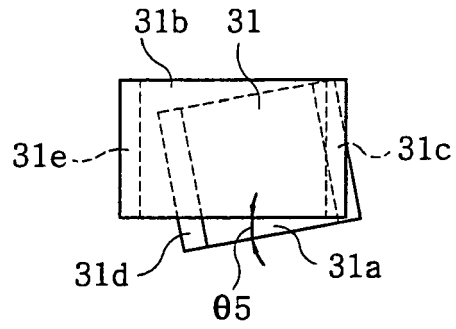


FIG. 5B

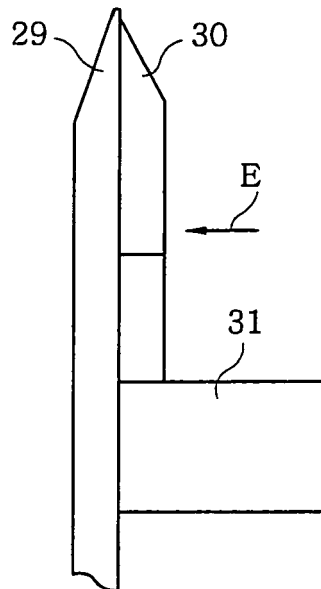


FIG. 6A

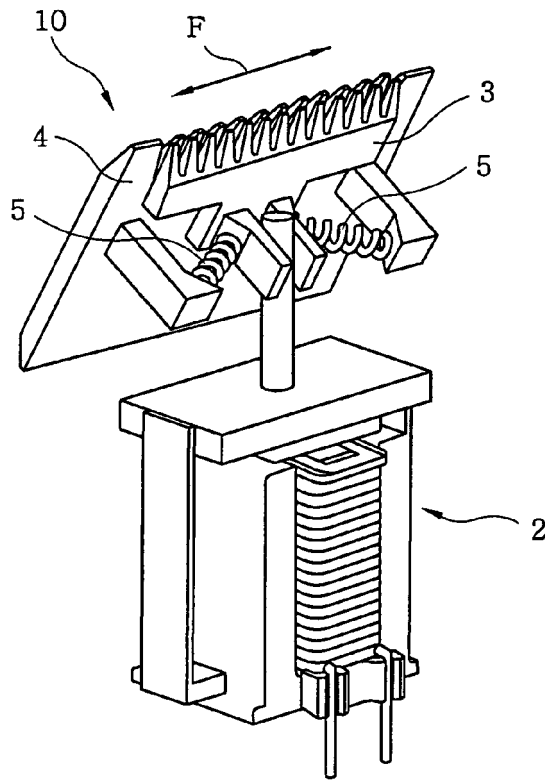


FIG. 6B

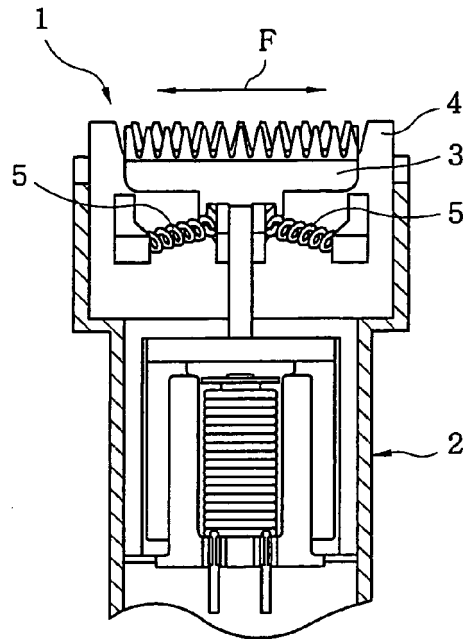


FIG. 7

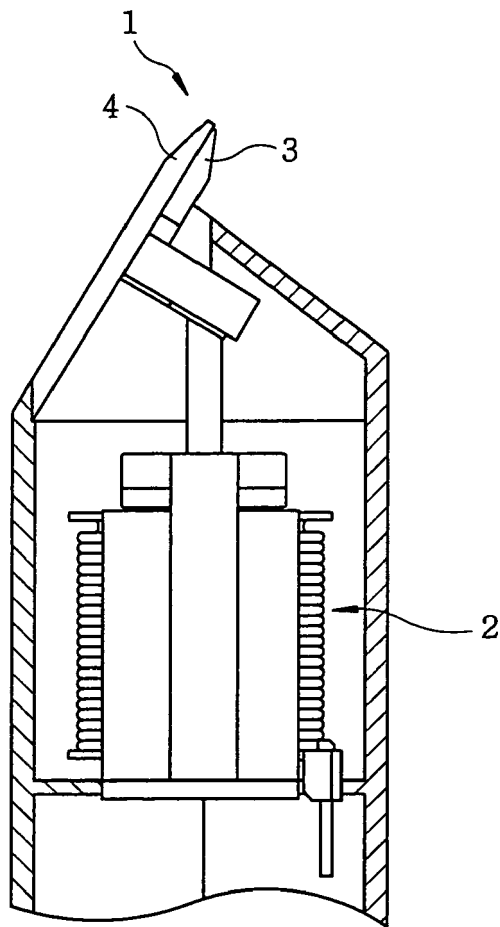


FIG. 8A

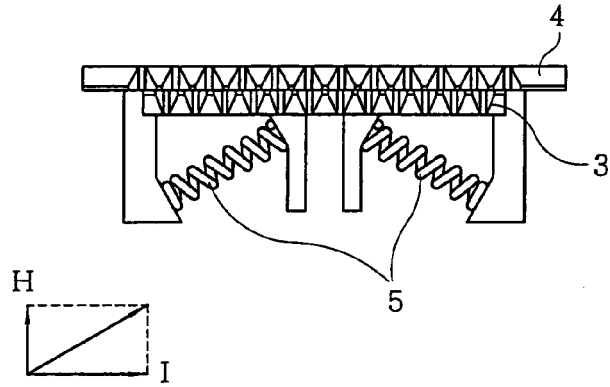


FIG. 8B

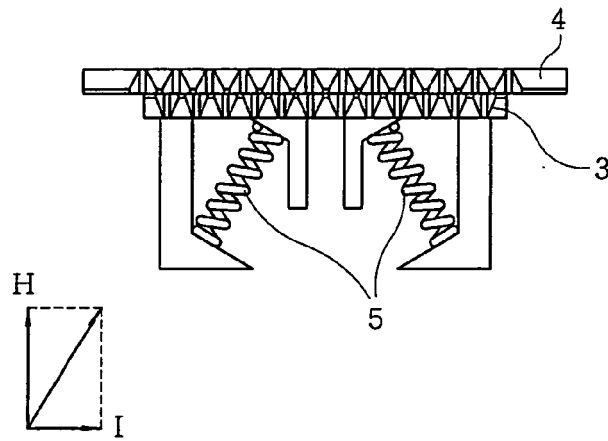
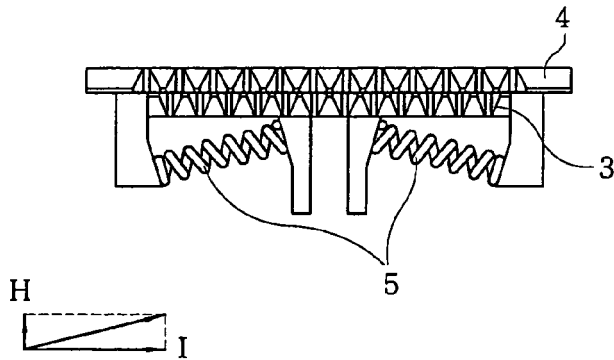


FIG. 8C





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B26B
Place of search		Date of completion of the search	Examiner
Munich		25 April 2007	RATTENBERGER, B
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