(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 926 958 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.10.2015 Bulletin 2015/41

(51) Int Cl.:
B26B 19/20 *(2006.01)*

(21) Application number: **15153725.5**

(22) Date of filing: **04.02.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **31.03.2014 JP 2014074545**

(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

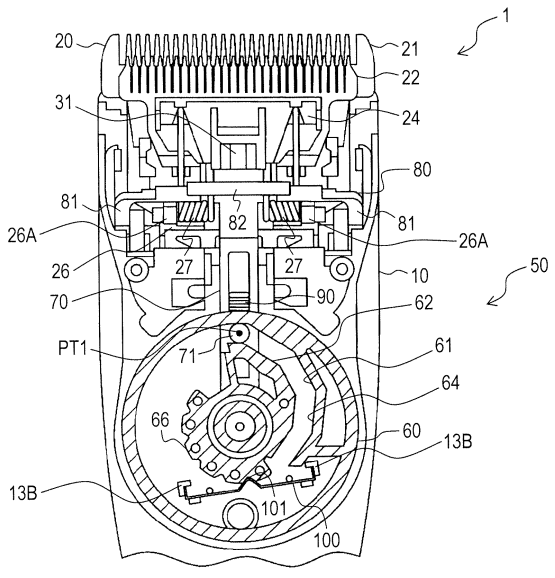
(72) Inventors:
- **Sobagaki, Satoshi**
  Osaka-shi Osaka 540-6207 (JP)
- **Ogawa, Hitoshi**
  Osaka-shi Osaka 540-6207 (JP)

(74) Representative: **Grünecker Patent- und Rechtsanwälte**
PartG mbB
Leopoldstraße 4
80802 München (DE)

(54) **Hair clippers**

(57) Hair clippers (1) include stationary blade (21), movable blade (22), main body (10), and dial (60). Guide groove (61) is formed in dial (60). Movable blade (22) slides relative to stationary blade (21) in a longer direction of main body (10) by moving boss (71) inserted into guide groove (61). A slide mechanism includes first spring (27) that pushes movable blade (22) against stationary blade (21), and second spring (90) that applies force to boss (71) in a direction opposite to first spring (27). Characteristics of first and second springs (27 and 90) are set such that a magnitude relation of the forces to boss (71) applied by first spring (27) and second spring (90) switches with a change in relative positions of guide groove (61) and boss (71). Accordingly, the hair clippers with pleasant operability can be offered.

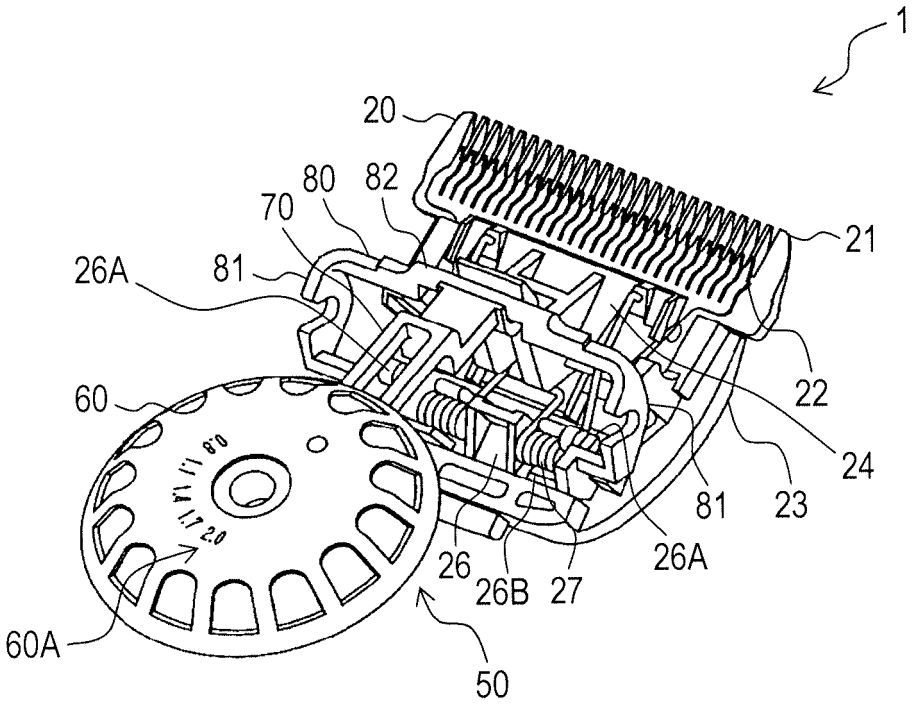
FIG. 5



EP 2 926 958 A1

(Cont. next page)

FIG. 6



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The disclosure relates to hair clippers for haircut that can adjust the clipping height.

2. Background Art

[0002] In one embodiment of conventional hair clippers, the clipping height of hair clippers is changed by rotating a dial attached to its main body. PTL 1 (Japanese Patent Publication No. 4046098) discloses this type of hair clippers. The clipping height is a distance between a hair root and a point of hair cut by hair clippers. The length of hair after cutting depends on this clipping height.

[0003] The hair clippers can cut hair by sliding a movable blade attached to its main body in a direction perpendicular to a longer direction of the main body (hereafter referred to as a shorter direction) relative to a stationary blade attached to the main body. The clipping height can be changed by sliding the movable blade relative to the stationary blade in the longer direction of the main body.

[0004] A spiral guide groove is formed in a dial. The dial and the movable blade are connected by a slide mechanism for sliding the movable blade in the longer direction of the main body. The slide mechanism includes a link with boss to be fitted into the guide groove. A first spring is attached between the link and the movable blade. This first spring pushes the movable blade against the stationary blade and also applies force to the movable blade so as to move the movable blade toward the main body. A second spring is attached to the link. This second spring applies force to the link so as to move the movable blade away from the main body.

[0005] As the dial rotates, the guide groove moves relative to the boss. The boss and link slide in the longer direction of the main body along the guide groove. As a result, the movable blade slides relative to the stationary blade in the longer direction of the main body by the force applied from the link.

SUMMARY OF THE INVENTION

[0006] In the hair clippers disclosed in PTL1, a slider is pushed resisting the force of the first spring when the dial rotates counterclockwise, and thus a large reactive force acts on the dial. On the other hand, when the dial rotates clockwise, the slider is pushed in a restoring direction of the first spring. This enables the user to rotate the dial with a relatively small force. In this way, there is a large difference between force applied to the dial for rotating the dial counterclockwise and force applied to the dial for rotating the dial clockwise in the hair clippers of PTL1. Accordingly, the user may feel discomfort with this large difference in force required for operation depending on the operating directions. In addition, the user may feel burdened to rotate the dial counterclockwise because a large reactive force acts on the dial at rotating the dial counterclockwise. An example of hair clippers that change the clipping height with the spiral guide groove is given in the description. However, a similar disadvantage also occurs with hair clippers that change the clipping height by a control section with guide groove extending in the shorter direction of the main body.

[0007] An object of the disclosure is to offer hair clippers that the user can operate a control section pleasantly.

[0008] The hair clippers of the disclosure include a stationary blade, movable blade, main body, control section, and slide mechanism. The movable blade slides relative to the stationary blade. The stationary blade and the movable blade are attached to the main body. The control section is disposed on the main body, and a guide groove is formed on the control section.

[0009] The slide mechanism includes a slider, first spring, link, and second spring. The movable blade is attached to the slider. The slider slides relative to the stationary blade in the longer direction and shorter direction of the main body. The first spring applies force to the slider such that the movable blade is pushed against the stationary blade and the slider movers toward the main body. The link has a boss to be inserted into the guide groove, and slides relative to the main body in the longer direction of the main body. The second spring applies force to the link such that the link moves toward the slider.

[0010] The first spring further applies force to the boss to push the boss against a first side face or second side face along the extending direction of the guide groove. The second spring further applies force to the boss to push the boss in a direction opposite to the direction that the first spring pushes the boss.

[0011] By operating the control section, a position of the boss relative to the guide groove change. By this change in relative positions, the link moves in the longer direction of the main body. By this movement of the link, the slider and movable blade slide relative to the stationary blade in the longer direction of the main body. Characteristics of the first spring and characteristics of the second spring are set such that a magnitude relation of the forces applied to the boss by the first spring and the second spring switches with the change in a position of the boss relative to the guide groove.

[0012] Accordingly, the disclosure enables the user to operate the control section pleasantly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a front view of hair clippers in accordance with an exemplary embodiment.

Fig. 2 is a front view of a dial placement part in ac-

cordance with the exemplary embodiment.
Fig. 3 is a perspective view of a blade block in accordance with the exemplary embodiment.
Fig. 4 is a rear view of a dial in accordance with the exemplary embodiment.
Fig. 5 is a fragmentary sectional view of the hair clippers when a dial rotating position is at a first limit fixing position in accordance with the exemplary embodiment.
Fig. 6 is a perspective view of the dial and blade block when the dial rotating position is at the first limit fixing position in accordance with the exemplary embodiment.
Fig. 7 is a fragmentary sectional view of the hair clippers when the dial rotating position is at a third intermediate fixing position in accordance with the exemplary embodiment.
Fig. 8 is a perspective view of the dial and blade block when the dial rotating position is at the third intermediate fixing position in accordance with the exemplary embodiment.
Fig. 9 is a fragmentary sectional view of the hair clippers when the dial rotating position is at a second limit fixing position in accordance with the exemplary embodiment.
Fig. 10 is a perspective view of the dial and blade block when the dial rotating position is at the second limit fixing position in accordance with the exemplary embodiment.
Fig. 11 is an interaction diagram illustrating a relation of a boss and guide groove in accordance with the exemplary embodiment.
Fig. 12 is a graph illustrating a dial operating force of the hair clippers in the exemplary embodiment and a dial operating force of hair clippers in comparisons.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

(Exemplary embodiments of hair clippers of the disclosure)

[0014]

[1] The hair clippers in a first exemplary embodiment of the disclosure include a stationary blade, movable blade, main body, control section, and slide mechanism. The movable blade slides relative to the stationary blade. The stationary blade and movable blade are attached to the main body. The control section is disposed on the main body, and a guide groove is formed on the control section.
The slide mechanism includes a slider, first spring, link, and second spring. The movable blade is attached to the slider. The slider slides relative to the stationary blade in a longer direction and shorter direction of the main body. The first spring applies force to the slider such that the movable blade is pushed against the stationary blade and the slider moves toward the main body. The link has a boss to be inserted into the guide groove, and slides relative to the main body in the longer direction of the main body. The second spring applies force to the link such that the link moves toward the slider.
The first spring further applies force to the boss to push the boss to a first side face or second side face disposed along an extending direction of the guide groove. The second spring applies force to the boss to push the boss in a direction opposite to the direction that the first spring pushes the boss.
A position of the boss relative to the guide groove change by operating the control section. This change in relative positions moves the link in the longer direction of the main body. By this movement of the link, the slider and movable blade slide relative to the stationary blade in the longer direction of the main body. Characteristics of the first spring and characteristics of the second spring are set such that a magnitude relation of the forces applied to the boss by the first spring and the second spring switches with the change in a position of the boss relative to the guide groove.
In the exemplary embodiment, a difference becomes small between force applied by the user to the control section for changing the position of the boss relative to the guide groove from one to the other and force applied to the control section by the user for changing the position of the boss relative to the guide groove from the other to one, in comparison with a case when the magnitude relation of the forces applied to the boss by the first spring and the second spring does not switch. This enables the user to operate the control section pleasantly. Accordingly, a burden that the user may feel at changing the relative positions of the boss and guide groove can be reduced. As a result, user's sense of discomfort can be reduced.

* [2] In hair clippers in a second exemplary embodiment of the disclosure, a spiral guide groove is formed on a dial, which is the control section. The slide mechanism further includes a coupling lever and blade lever. The coupling lever is supported by the main body such that it can rotate relative to the main body. The coupling lever includes an arm and a shaft in contact with the link, and rotates relative to the main body according to a relation of force applied from the slider and force applied from the link. The blade lever is supported by the main body such that it can rotate relative to the main body, and includes an arm in contact with the arm of the coupling lever. The blade lever rotates relative to the main body according to a relation of force applied from the first spring coupled to the slider and force applied from the coupling lever. This makes the slider and movable blade slide relative to the stationary blade

in the longer direction of the main body.
Since the guide groove is spiral in this exemplary embodiment, a sliding amount of movable blade can be increased relative to the stationary blade, in comparison with that of the linear guide groove. As a result, the clipping height can be largely changed.

[3] In hair clippers in a third exemplary embodiment of the disclosure, the boss is pushed against the first side face that is a side face at the opposite side of the slider in the first side face and the second side face when the position of the boss relative to the guide groove are set such that the force that the first spring applies to the boss is greater than the force that the second spring applies to the boss. The boss is pushed against the second side face at the slider side in the first side face and the second side face when the position of the boss relative to the guide groove are set such that the force that the second spring applies to the boss is greater than the force that the first spring applies to the boss.
When the boss is at a position between the first side face and the second side face, the boss easily moves between the first side face and the second side face typically due to vibration. Therefore, the position of movable blade relative to the stationary blade in the longer direction of the main body may change and cause unstable clipping height. In this exemplary embodiment, however, the boss is pushed against the first side face or the second side face, and thus movement of the boss between the first side face and the second side face can be suppressed. As a result, a stable clipping height is achieved.

[4] Hair clippers in a fourth exemplary embodiment of the disclosure further includes a holding mechanism with multiple fixing positions for fixing the operating position of the control section so that the position of the boss relative to the guide groove can be changed stepwise. The multiple fixing positions include a first limit fixing position that is a one side limit of position of the boss relative to the guide groove, a second limit fixing position that is an another side limit of position of the boss relative to the guide groove, and one or more intermediate fixing positions between the first limit fixing position and second limit fixing position. The magnitude relation of the forces applied to the boss by the first spring and the second spring when the position of the boss relative to the guide groove is set to the first limit fixing position is different from that when the position of the boss relative to the guide groove are set to the second limit fixing positions.

[5] In hair clippers in a fifth exemplary embodiment of the disclosure, the characteristics of the first spring and the characteristics of the second spring are set such that the magnitude relation of the forces applied to the boss by the first spring and the second spring reverses in a process that the position of the boss relative to the guide groove change to one intermediate fixing position or in a process that the position of the boss relative to the guide groove change to one of the intermediate fixing positions.

[6] In hair clippers in a sixth exemplary embodiment of the disclosure, the clipping height of the hair clippers becomes longer as the position of the boss relative to the guide groove move from the second limit fixing position to the first limit fixing position. The clipping height of the hair clippers becomes shorter as the position of the boss relative to the guide groove move from the first limit fixing position to the second limit fixing position. When the position of the boss relative to the guide groove are fixed at the first limit fixing position, the force that the first spring applies to the boss is greater than the force that the second spring applies to the boss. When the position of the boss relative to the guide groove are fixed at the second limit fixing position, the force that the second spring applies to the boss is greater than the force that the first spring applies to the boss.

[7] In hair clippers in a seventh exemplary embodiment of the disclosure, a width of the guide groove and a diameter of the boss are set such that there is practically no clearance between the first side face of the guide groove and the boss and between the second side face of the guide groove and the boss. When the force that the first spring applies to the boss and the force that the second spring applies to the boss are balanced, the boss easily moves between the first side face and the second side face. Therefore, the position of movable blade relative to the stationary blade in the longer direction of the main body may change and cause unstable clipping height. In this exemplary embodiment, however, there is no practical clearance between the boss and the first side face and between the boss and the second side face. This can suppress movement of the boss between the first side face and the second side face. As a result, a stable clipping height can be achieved even if the force that the first spring applies to the boss and the force that the second spring applies to the boss are balanced.

[8] In hair clippers in an eighth exemplary embodiment of the disclosure, a first support face that is a flat face against which the boss is pushed is formed at multiple points of the first side face of the guide groove. The support faces are formed such that a direction of force exerted by the boss upon the first support face is perpendicular or substantially perpendicular to the first support face when the position of the boss relative to the guide groove are fixed by the holding mechanism.

When the first side face against which the boss is pushed is tilted relative to the direction of force exerted by the boss, slipping tends to occur between the boss and the first side face. This may change the relative positions of the boss and guide groove. In this exemplary embodiment, however, since the direction of the force that the boss applies to the first support face is perpendicular to the first support face, slipping hardly occurs between the boss and first support face. As a result, the relative positions of the boss and guide groove can be appropriately retained.

[9] In hair clippers in a ninth exemplary embodiment of the disclosure, a second support face that is a flat face against which the boss is pushed is formed at multiple points on the second side face of the guide groove. The support faces are formed such that a direction of force exerted by the boss upon to the second support face is perpendicular or substantially perpendicular to the second support face when the position of the boss relative to the guide groove are fixed by the holding mechanism.

When the second side face against which the boss is pushed is tilted relative to the direction of force exerted by the boss, slipping tends to occur between the boss and the second side face. This may change the relative positions of the boss and guide groove. In this exemplary embodiment, however, since the direction of the force that the boss applies to the second support face is perpendicular to the second support face, slipping hardly occurs between the boss and second support face. As a result, the relative positions of the boss and guide groove can be appropriately retained.

(Exemplary embodiment)

[0015] A structure of hair clippers 1 is described with reference to Fig. 1 and Fig. 2.

[0016] As shown in Fig. 1, hair clippers 1 include main body 10, blade block 20, driver 30 (Fig. 2), cover 40, and adjustment mechanism 50.

[0017] Main body 10 has a substantially cylindrical shape for user to grip, and the shaft direction is formed in the longer direction. Switch 11 is provided on the surface of main body 10. Switch 11 switches connection between a battery of driver 30 disposed inside main body 10 and a motor (not illustrated).

[0018] As shown in Fig. 2, main body 10 includes blade block placement part 12 where blade block 20 (Fig. 1) is detachably mounted at its end and dial placement part 13 where dial 60 (Fig. 1) is disposed on its peripheral front face. Holding spring 100 is fitted to fixing part 13B of dial placement part 13. Hole 60B (Fig. 4) of dial 60 is fitted to support shaft 13A of dial placement part 13.

[0019] As shown in Fig. 1, cover 40 is fixed to main body 10 to cover a part of the surface of dial 60 in the state dial 60 is rotatably disposed on main body 10. Therefore, cover 40 suppresses detachment of dial 60 from main body 10.

[0020] A structure of blade block 20 is described with reference to Fig. 3.

[0021] Blade block 20 includes a pair of blades configured with stationary blade 21 and movable blade 22, support 23, slider 24, blade lever 26, and first spring 27.

[0022] Support 23 has a sheet shape, and multiple protrusions 23A to be fitted to multiple concavities 12A (Fig. 2) on blade block placement part 12 (Fig. 2) are formed near the periphery of its sheet shape. Stationary blade 21 is fixed at the end of support 23.

[0023] Slider 24 is attached to support 23 in a slidable manner in the longer direction and the short direction of main body 10. Movable blade 22 is fixed at a tip of slider 24.

[0024] Blade lever 26 is attached to support 23 in a rotatable manner relative to support 23. Slider 24 and blade lever 26 are connected by first spring 27, which is a double torsion spring.

[0025] Coil portion 27A of first spring 27 is attached to housing 26B of blade lever 26, and both ends 27B are attached to slider 24 at the side opposite to the side where slider 24 is in contact with support 23. This makes first spring 27 apply to movable blade 22 force to push movable blade 22 against stationary blade 21 and support 23 and force to move movable blade 22 relative to stationary blade 21 in the longer direction of main body 10 via slider 24.

[0026] Shaft groove 25 for fitting shaft 31 (Fig. 2) connected to the motor (not illustrated) is formed on slider 24. The force that first spring 27 applies to movable blade 2 to push movable blade 2 against stationary blade 21 and support 23 is smaller than the force that first spring 27 applies to movable blade 22 to move movable blade 22 relative to stationary blade 21 in the longer direction of main body 10. Therefore, when shaft 31 (Fig. 2) is operated, movable blade 22 slides relative to stationary blade 21 in the shorter direction of main body 10 while movable blade 22 remains pushed against stationary blade 21. This relative slide of movable blade 22 and stationary blade 21 cuts hair entering between movable blade 22 and stationary blade 21. The motor, such as a linear motor, that operates movable blade 22 in the shorter direction of main body 10 by eccentrically rotating shaft 31 or that reciprocates shaft 31 can be adopted.

[0027] Adjustment mechanism 50 is described with reference to Figs. 1 to 5.

[0028] As shown in Fig. 2, adjustment mechanism 50 includes dial 60 (Fig. 4), link 70 linked with dial 60, coupling lever 80 linked with link 70, and second spring 90 attached to link 70. Slider 24 (Fig. 3), blade lever 26 (Fig. 3), first spring 27 (Fig. 3), link 70, coupling lever 80, and second spring 90 configure the slide mechanism.

[0029] As shown in Fig. 4, dial 60 has a disk shape. A rear face of dial 60 is open, and spiral guide groove 61 and holder 66 protruding from the rear face at the side

opposite to guide groove 61 across the center are formed. As shown in Fig. 1, numerical scale 60A indicating the clipping height is provided on the surface of dial 60. Scale 60A is disposed at a position that only a numerical value corresponding to the current clipping height is exposed from window 41 of cover 40.

[0030] As shown in Fig. 4, boss 71 formed on one end of link 70 (Fig. 2) is inserted into guide groove 61. Guide groove 61 has first side face 62 at the inner peripheral side, which is the side opposite to slider 24 along the extending direction of guide groove 61, and second side face 64 at the outer peripheral side, which is the side of slider 24.

[0031] On first side face 62, five first support faces 63 are formed to push boss 71 against them. These five first support faces 63 are flat, and perpendicular to a line extending from the center of dial 60 in a radial direction.

[0032] On second side face 64, five second support faces 65 are formed to push boss 71 against them. These five second support faces 65 are flat and perpendicular to a line extending from the center of dial 60 in a radial direction.

[0033] A diameter of boss 71 is set slightly smaller than a width of guide groove 61. Therefore, there is practically no clearance between boss 71 and first side face 62 and between boss 71 and second side face 64.

[0034] Holder 66 is formed along the circumferential direction, and multiple concavities 66A are formed at the outer peripheral side. Top 101 of angle holding spring 100 to be fixed to fixing part 13B (Fig. 2) is fitted to one of concavities 66A. When top 101 of holding spring 100 is fitted to concavity 66A, dial 60 is hard to rotate due to the force of holding spring 100. Accordingly, a rotating position of dial 60 will be fixed. When force is applied to dial 60 to rotate dial 60, holding spring 100 deforms and top 101 is released from concavity 66A where it has been fitted. Then, when concavity 66A next to concavity 66A where top 100 has been fitted comes to face top 101, top 101 fits into this concavity 66A. In this way, relative positions of guide groove 61 and boss 71, i.e., the rotating position of dial 60, include multiple fixing positions P by fitting concavity 66A and holding spring 100, and change stepwise. The holding mechanism is configured with holding part 66 and holding spring 100.

[0035] Fixing position P changes between first limit fixing position PT1 that is a limit rotating position in clockwise rotation of dial 60 and second limit fixing position PT2 that is a limit rotating position in counterclockwise rotation. The clockwise rotation of dial 60 is a direction to increase the clipping height of hair clippers 1. The counterclockwise rotation decreases the clipping height of hair clippers 1. There are three intermediate fixing positions PM between first limit fixing position PT1 and second limit fixing position PT2. These three intermediate fixing positions PM include first intermediate fixing position PM1, second intermediate fixing position PM2, and third intermediate fixing position PM3. First intermediate fixing position PM1 is adjacent to first limit fixing position PT1. Second intermediate fixing position PM2 is adjacent to second limit fixing position PT2. Third intermediate fixing position PM3 is between first intermediate fixing position PM1 and second intermediate fixing position PM2. Each fixing position P corresponds to the rotating position of dial 60 where top 101 is fitted to one concavity 66A in multiple concavities 66A.

[0036] As shown in Fig. 5, the other end of link 70 is attached to shaft 82 of coupling lever 80 rotatably supported by main body 10. By guiding boss 71 along guide groove 61, link 70 slides relative to main body 10 in the longer direction of main body 10. Second spring 90 that applies force to link 70 toward main body 10 is attached to the other end of link 70.

[0037] Shaft 82 of coupling lever 80 extends in the shorter direction of main body 10. Arms 81 are formed on both ends of shaft 82. Arms 81 are in contact with arms 26A of blade lever 26. Coupling lever 80 rotates relative to main body 10 when link 70 slides relative to main body 10 in the longer direction of main body 10. More specifically, coupling lever 80 rotates relative to main body 10 corresponding to the relation of force applied from slider 24 via blade lever 26 and force applied from link 70.

[0038] When fixing position P is at first limit fixing position PT1, no force from the outside of blade block 20 is applied to blade lever 26. Here, the rotation of blade lever 26 is restricted by rotation regulator 23B of support 23. At this point, movable blade 22 is at a position closest to main body 10. A tip of movable blade 22 and a tip of stationary blade 21 are furthest to each other and thus the hair clipping height becomes the longest. First limit fixing position PT1 is regulated by the limit fixing position of the rotation of coupling lever 80 as a result of coupling lever 80 in contact with main body 10.

[0039] If force from the outside of blade block 20 is applied to blade lever 26 when fixing position P is at second limit fixing position PT2, the rotation of blade lever 6 becomes large. When the largest force is applied, movable blade 22 reaches a position furthest from main body 10. Here, the tip of movable blade 22 and the tip of stationary blade 21 come closest, and thus the hair clipping height becomes the shortest. Second limit fixing position PT2 is regulated by the slide limit fixing position of link 70 as a result of link 70 in contact with main body 10.

[0040] Next, the operation of adjustment mechanism 50 when dial 60 is rotated is described with reference to Fig. 5 to Fig. 10.

[0041] As shown in Fig. 5, when fixing position P is at first limit fixing position PT1, link 70 is at a position closest to slider 24 as shown in Fig. 6. Here, arm 81 of coupling lever 80 is in contact with arm 26A of blade lever 26. At this point, movable blade 22 is closest to main body 10. In addition, as shown in Fig. 5, second spring 90 is most contracted. Therefore, force applied from second spring 90 to boss 71 becomes the largest.

[0042] As shown in Fig. 7, when dial 60 is operated counterclockwise and fixing position P changes from first

limit fixing position PT1 to third intermediate fixing position PM3, link 70 is pulled to the side of main body 10 resisting the force of first spring 27, as shown in Fig. 8. Here, shaft 82 of coupling lever 80 is pulled toward main body 10, and arm 81 pushes arm 26A of blade lever 26 to the side away from main body 10. This makes movable blade 22 move to the side away from main body 10, compared to that in Fig. 6, by being pushed by slider 24. As shown in Fig. 7, second spring 90 is also stretched, compared to that in Fig. 5. Accordingly, the force that second spring 90 applies to boss 71 becomes smaller than that when fixing position P is at first limit fixing position PT1 and first intermediate fixing position PM1.

[0043] As shown in Fig. 9, when dial 60 is operated counterclockwise and fixing position P changes from third intermediate fixing position PM3 to second limit fixing position PT2, link 70 is pulled to the side of main body 10 resisting the force of first spring 27. Here, shaft 82 of coupling lever 80 is pulled toward main body 10, and arm 81 pushes arm 26A of blade lever 26 to the side away from main body 10. This makes movable blade 22 move to the side away from main body 10, compared to that in Fig. 8, by being pushed by slider 24. At this point, as shown in Fig. 9, second spring 90 is more stretched, compared to that in Fig. 7. Accordingly, the force that second spring 90 applies to boss 71 becomes smaller than that when fixing position P is at intermediate fixing position PM.

[0044] When dial 60 is operated clockwise and fixing position P changes from second limit fixing position PT2 to third intermediate fixing position PM3, link 70 moves away from main body 10 resisting the force of second spring 90, as shown in Fig. 7. Here, arm 81 is pushed away from main body 10 by the force of first spring 27 via arm 26 of blade lever 26. This makes movable blade 22 move toward main body 10, compared to that in Fig. 10, by being pulled by slider 24.

[0045] When dial 60 is operated clockwise and fixing position P changes from third intermediate fixing position PM3 to first limit fixing position PT1, link 70 moves away from main body 10 resisting the force of second spring 90, as shown in Fig. 5. Here, arm 81 is pushed away from main body 10 by the force of first spring 27 via arm 26A of blade lever 26. This makes movable blade 22 move toward main body 10, compared to that in Fig. 8, by being pulled by slider 24.

[0046] Next, a relation of guide groove 61 and boss 71 at each fixing position P is described with reference to Fig. 11.

[0047] When fixing position P is at first limit fixing position PT1, the force that first spring 27 applies to boss 71 is greater than the force that second spring 90 applies to boss 71, and thus boss 71 is pushed against first support face 63 corresponding to first limit fixing position PT1. Here, a direction of force exerted by boss 1 upon first support face 63 is perpendicular to first support face 63.

[0048] When fixing position P is at first intermediate fixing position PM1, the force that first spring 27 applies to boss 71 is greater than the force that second spring 90 applies to boss 71, and thus boss 71 is pushed against first support face 63 corresponding to first intermediate fixing position PM1. Here, a direction of force exerted by boss 71 upon first support face 63 is perpendicular to first support face 63.

[0049] When fixing position P is at second limit fixing position PT2, the force that second spring 90 applies to boss 71 is greater than the force that first spring 27 applies to boss 71, and thus boss 71 is pushed against second support face 65 corresponding to second limit fixing position PT2. Here, a direction of force exerted by boss 71 upon second support face 65 is perpendicular to second support face 65.

[0050] When fixing position P is at second intermediate fixing position PM2, the force that second spring 90 applies to boss 71 is greater than the force that first spring 27 applies to boss 71, and thus boss 71 is pushed against second support face 65 corresponding to intermediate fixing position PM2. Here, a direction of force exerted by boss 71 upon second support face 65 is perpendicular to second support face 65.

[0051] When fixing position P is at third intermediate fixing position PM3, the force that first spring 27 applies to boss 71 and the force that second spring 90 applies to boss 71 are balanced. In other words, the magnitude relation of the forces applied to boss 71 by first spring 27 and second spring 90 reverses in a process that fixing position P changes from intermediate fixing position PM2 to first intermediate fixing position PM1 and in a process that fixing position P changes from first intermediate fixing position PM1 to second intermediate fixing position PM2.

[0052] Interaction of hair clippers 1 is described with reference to Fig. 12.

[0053] Broken lines in Fig. 12 show force required for the user to rotate dial 60 (hereafter referred to as "dial operating force") in hair clippers of Comparison 1 without second spring 90. As shown by the broken line with circle in Fig. 12, an approximately constant high dial operating force is required for changing fixing position P from first limit fixing position PT1 to third intermediate fixing position PM3 and second limit fixing position PT2. On the other hand, as shown by the broken line with triangle in Fig. 12, an approximately constant low dial operating force is required for changing fixing position P from second limit fixing position PT2 to third intermediate fixing position PM3 and first limit fixing position PT1.

[0054] In the hair clippers of Comparison 1, as described above, the dial operating force greatly differs for changing fixing position P from first limit fixing position PT1 to second limit fixing position PT2 and for changing from second limit fixing position PT2 to first limit fixing position PT1. Accordingly, the user tends to feel discomfort that load needed to change fixing position P from second limit fixing position PT2 to first limit fixing position PT1 is greater than load for changing to first limit fixing position PT1.

[0055] Two-dot chain lines in Fig. 12 show the dial operating force of hair clippers in Comparison 2 in which the force that second spring 90 applies to boss 71 is always lower than the force that first spring 27 applies to boss 71. As shown by the two-dot chain line with circle in Fig. 12, the dial operating force slightly decreases toward second limit fixing position PT2 when fixing position P is changed from first limit fixing position PT1 to third intermediate fixing position PM3 and second limit fixing position PT2. As shown by the two-dot chain line with triangle, the dial operating force slightly decreases when fixing position P is changed from second limit fixing position PT2 to third intermediate fixing position PM3 and first limit fixing position PT1. Here, the dial operating force is always lower than that required for changing fixing position P from first limit fixing position PT1 to third intermediate fixing position PM3 and second limit fixing position PT2.

[0056] In the hair clippers of Comparison 2, as described above, the dial operating force greatly differs for changing fixing position P from first limit fixing position PT1 to second limit fixing position PT2 and for changing from second limit fixing position PT2 to first limit fixing position PT1. Accordingly, the user tends to feel discomfort that load needed to change fixing position P toward second limit fixing position PT2 is greater than load for changing to first limit fixing position PT1.

[0057] Solid lines in Fig. 12 show the dial operating force of hair clippers 1. As shown by the solid line with circle in Fig. 12, the dial operating force decreases toward second limit fixing position PT2 when fixing position P is changed from first limit fixing position PT1 to third intermediate fixing position PM3 and second limit fixing position PT2. On the other hand, as shown by the solid line with triangle in Fig. 12, the dial operating force decreases when fixing position P is changed from second limit fixing position PT2 to third intermediate fixing position PM3 and first limit fixing position PT1. At third intermediate fixing position PM3, the solid line with circle and the solid line with triangle in Fig. 2 cross. In other words, the force that first spring 27 applies to boss 71 and the force that second spring 90 applies to boss 71 are balanced at third intermediate fixing position PM3. Still more, increase in the solid line with circle and increase in the solid line with triangle in Fig. 12 are substantially equivalent. Accordingly, in hair clippers 1, the operating force for changing fixing position P from first limit fixing position PT1 to second limit fixing position PT2 and the operating force for changing fixing position P from second limit fixing position PT2 to first limit fixing position PT1 show bilateral symmetry in the graph. Therefore, compared to Comparison 1 and Comparison 2, the user unlikely feels discomfort due to larger load for rotating in one direction than that for rotating in the other direction when the user changes fixing position P toward second limit fixing position PT2 and toward first limit fixing position PT1.

[0058] Furthermore, the dial operating force required for changing fixing position P from first limit fixing position PT1 to second limit fixing position PT2 in hair clippers 1 is smaller than the dial operating force required in Comparison 1 and Comparison 2. This can suppress generation of a large reactive force on dial 60 when changing fixing position P from first limit fixing position PT1 to second limit fixing position PT2 in hair clippers 1.

[0059] Hair clippers 1 prove effective as follows.

(1) In hair clippers 1, the magnitude relation of the forces to boss 71 applied by first spring 27 and second spring 90 switches with a change in relative positions of guide groove 61 and boss 71. This makes a difference small between the operating force of dial 60 required for the user to change the relative positions of guide groove 61 and boss 71 from one to the other and the operating force of dial 60 required for the user to change the relative positions of guide groove 61 and boss 71 from the other to one. The user can thus operate dial 60 pleasantly. In addition, generation of a large reactive force on dial 60 due to the force of second spring 90 can be suppressed. Accordingly, a risk that the user feels burdened to rotate dial 60 counterclockwise can be reduced. As a result, user's feel of discomfort can be reduced.

(2) Hair clippers 1 has spiral guide groove 61. Compared to linear guide groove 61, a sliding amount of movable blade 22 relative to stationary blade 221 can be increased. As a result, the clipping height can be changed more.

(3) When boss 71 is at a position between first side face 62 and second side face 64, boss 71 likely moves between first side face 62 and second side face 64, typically due to vibration. This may change the position of movable blade 22 relative to stationary blade 21 in the longer direction of main body 10, resulting in an unstable clipping height. In hair clippers 1, however, boss 71 is pushed against first side face 62 or second side face 64. Accordingly, movement of boss 71 between first side face 62 and second side face 64 can be suppressed. As a result, a stable clipping height can be achieved.
Furthermore, the clipping height can be accurately adjusted by setting the slide position of movable blade 22 relative to stationary blade 21 in the longer direction of main body 10 based on first side face 62 or second side face 64 against which boss 71 is pushed.

(4) When the force applied from first spring 27 to boss 71 and the force applied from second spring 90 to boss 71 are balanced, boss 71 likely moves between first side face 62 and second side face 64. This may change the position of movable blade 22 relative to stationary blade 21 in the longer direction of main body 10, resulting in an unstable clipping height. In hair clippers 1, however, there is practically no clearance between boss 71 and first side face 62 and between boss 71 and second side face 64. Accordingly, movement of boss 71 between first side

face 62 and second side face 64 can be suppressed. As a result, a stable clipping height can be achieved even if the force applied from first spring 27 to boss 71 and the force applied from second spring 90 to boss 71 are balanced.

(5) In hair clippers 1, a direction of force exerted by boss 71 upon first support face 63 is perpendicular to first support face 63, and thus slipping of boss 71 and first support face 63 unlikely occurs. Accordingly, the relative positions of boss 71 and guide groove 61 can be appropriately retained.

(6) In hair clippers 1, a direction of force exerted by boss 71 upon second support face 65 is perpendicular to second support face 65, and thus slipping of boss 71 and second support face 65 unlikely occurs. Accordingly, the relative positions of boss 71 and guide groove 61 can be appropriately retained.

(Modification)

[0060] Specific embodiments of the hair clippers disclosed are not limited to the above exemplary embodiments. The hair clippers of the disclosure may be practiced or embodied in still other ways without departing from the spirit or essential character thereof. The following modifications to the above exemplary embodiments of the hair clippers disclosed are therefore to be considered in all respects as illustrative and not restrictive.

- The force applied from first spring 27 to boss 71 and the force applied from second spring 90 to boss 71 may balance at first intermediate fixing position PM1, second intermediate fixing position PM2, or between two adjacent fixing positions P.
- A width of guide groove 61 may be set to practically create clearance between boss 71 and first side face 62 and between boss 71 and second side face 64 at a portion corresponding to third intermediate fixing positon PM3.
- A width of guide groove 61 may be set to have no practical clearance between boss 71 and first side face 62 and between boss 71 and second side face 64 at a portion corresponding to third intermediate fixing positon PM3, but have practical clearance at other portions. Also in this case, movement of boss 71 is suppressed at third intermediate fixing position PM3 where the force applied from first spring 27 to boss 71 and the force applied from second spring 90 to boss 71 are balanced. As a result, an unstable clipping height can be suppressed.
- First support face 63 may be tilted toward a direction of force exerted by boss 71.
- Second support face 65 may be tilted toward a direction of force exerted by boss 71.
- Guide groove 61 may be changed to a linear groove that is tilted in the shorter direction or a stepped groove. In this case, a slide control section that slides in the extending direction of guide groove 61 can be adopted, instead of dial 60. Still more, a lever may be adopted as the control section, instead of dial 60. As the lever coupled to link 70 moves in the extending direction of the groove, movable blade changes relative to stationary blade 21 in the longer direction of main body 10 via the slide mechanism, and thus the clipping height can be changed.
- A structure may be changed to decrease the clipping height when dial 60 is rotated clockwise and increase the clipping height when rotated counterclockwise.

[0061] Intermediate fixing position PM may be provided at one, two, or four or more points.

- Intermediate fixing position PM may be eliminated. In this case, the clipping height can be changed in two levels.
- The holding mechanism may be eliminated.
- Blade lever 26 may be eliminated to attach coupling lever 80 to first spring 27. In short, any structure can be adopted as long as it is a slide mechanism to move movable blade 22 relative to stationary blade 21 in the longer direction of main body 10 by moving link 70 in the longer direction of main body 10.

Claims

1. Hair clippers comprising:

a stationary blade;
a movable blade that slides relative to the stationary blade;
a main body to which the stationary blade and the movable blade are attached;
a control section disposed on the main body and having a guide groove; and
a slide mechanism including:

a slider to which the movable blade is attached, the slider configured to slide relative to the stationary blade in a longer direction and a shorter direction of the main body;
a first spring applying force to the slider to push the movable blade against the stationary blade and move the slider toward the main body;
a link having a boss inserted in the guide groove, and configured to slide relative to the main body in the longer direction of the main body; and
a second spring applying force to the link to move the link toward the slider,

wherein
the first spring applies force to the boss to push the boss against one of a first side face and a second side face disposed along an extending

direction of the guide groove,
the second spring applies force to the boss to push the boss in a direction opposite to a direction that the first spring pushes the boss,
a position of the boss relative to the guide groove change by operating the control section, this change in the relative positions causes the link to move in the longer direction of the main body, and this movement of the link makes the slider and the movable blade slide relative to the stationary blade in the longer direction of the main body, and
a characteristic of the first spring and a characteristic of the second spring are set such that a magnitude relation of the forces applied to the boss by the first spring and the second spring switches with a change in the position of the boss relative to the guide groove.

2. The hair clippers of claim 1,
wherein
the guide groove with a spiral shape is formed in a dial, which is the control section, and
the slide mechanism further includes:

a coupling lever supported by the main body to be rotatable relative to the main body, the coupling lever including an arm and a shaft in contact with the link, and configured to rotate relative to the main body depending on a relation of force received from the slider and force received from the link, and
a blade lever supported by the main body to be rotatable relative to the main body, the blade lever including an arm in contact with the arm of the coupling lever, and configured to rotate relative to the main body depending on a relation of force received from the first spring coupled to the slider and force received from the coupling lever, so as to slide the slider and the movable blade relative to the stationary blade in the longer direction of the main body.

3. The hair clippers of claim 1,
wherein
when the position of the boss relative to the guide groove are such that the force applied to the boss by the first spring is greater than the force applied to the boss by the second spring, the boss is pushed against the first side face that is a side face located opposite to the slider, between the first side face and the second side face, and
when the position of the boss relative to the guide groove are such that the force applied to the boss by the second spring is greater that the force applied to the boss by the first spring, the boss is pushed against the second side face that is a side face located adjacent to the slider, between the first side face and the second side face.

4. The hair clippers of claim 1, further comprising a holding mechanism having a plurality of fixing positions for fixing an operating position of the control section so that the position of the boss relative to the guide groove change stepwise,
wherein
the plurality of fixing positions include a first limit fixing position that is a one side limit of the position of the boss relative to the guide groove, a second limit fixing position that is an another side limit of the position of the boss relative to the guide groove, and one or more intermediate fixing positions between the first limit fixing position and the second limit fixing position, and
the magnitude relation of the forces applied to the boss by the first spring and the second spring when the position of the boss relative to the guide groove are set to the first limit fixing position is different from that when the position of the boss relative to the guide groove are set to the second limit fixing position.

5. The hair clippers of claim 4,
wherein
the characteristic of the first spring and the characteristic of the second spring are set such that the magnitude relation of the forces applied to the boss by the first spring and the second spring reverses in a process of changing the position of the boss relative to the guide groove to the one intermediate fixing position or one of the intermediate fixing positions.

6. The hair clippers of claim 4,
wherein
a clipping height of the hair clippers increases as the position of the boss relative to the guide groove move from the second limit fixing position to the first limit fixing position, and the clipping height of the hair clippers decreases as the position of the boss relative to the guide groove move from the first limit fixing position to the second limit fixing position,
the force applied to the boss by the first spring is greater than the force applied to the boss by the second spring when the position of the boss relative to the guide groove are fixed to the first limit fixing position, and
the force applied to the boss by the second spring is greater than the force applied to the boss by the first spring when the position of the boss relative to the guide groove are fixed to the second limit fixing position.

7. The hair clippers of claim 1,
wherein
a width of the guide groove and a diameter of the boss are set such that there is practically no clearance between the first side face of the guide groove

and the boss and between the second side face of the guide groove and the boss.

8. The hair clippers of claim 4, wherein a first support face that is a flat face against which the boss is pushed is formed at a plurality of points on the first side face of the guide groove, and the first support face is formed such that a direction of force exerted by the boss upon the first support face is perpendicular or substantially perpendicular to the first support face when the position of the boss relative to the guide groove are fixed by the holding mechanism.

9. The hair clippers of claim 4, wherein a second support face that is a flat face against which the boss is pushed is formed at a plurality of points on the second side face of the guide groove, and the second support face is formed such that a direction of force exerted by the boss upon the second support face is substantially perpendicular to the second support face when the position of the boss relative to the guide groove are fixed by the holding mechanism.

FIG. 1

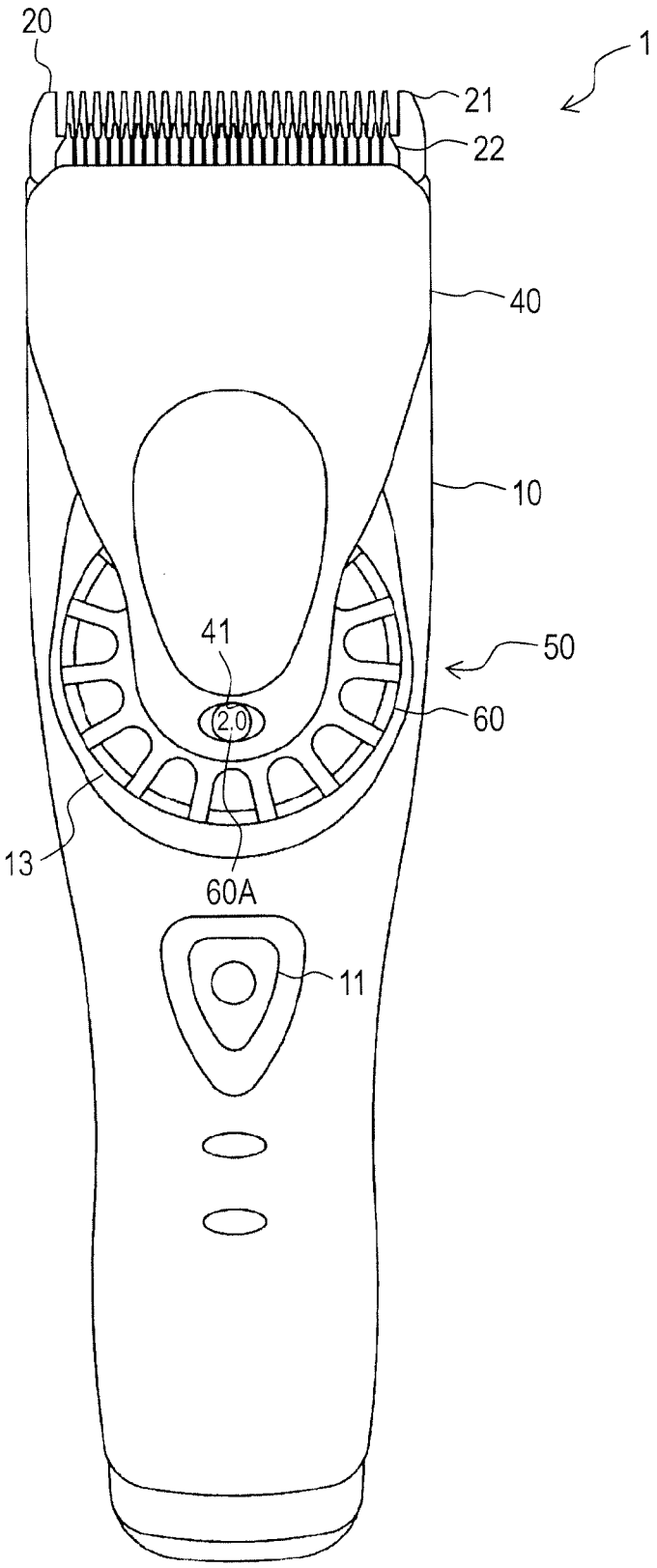


FIG. 2

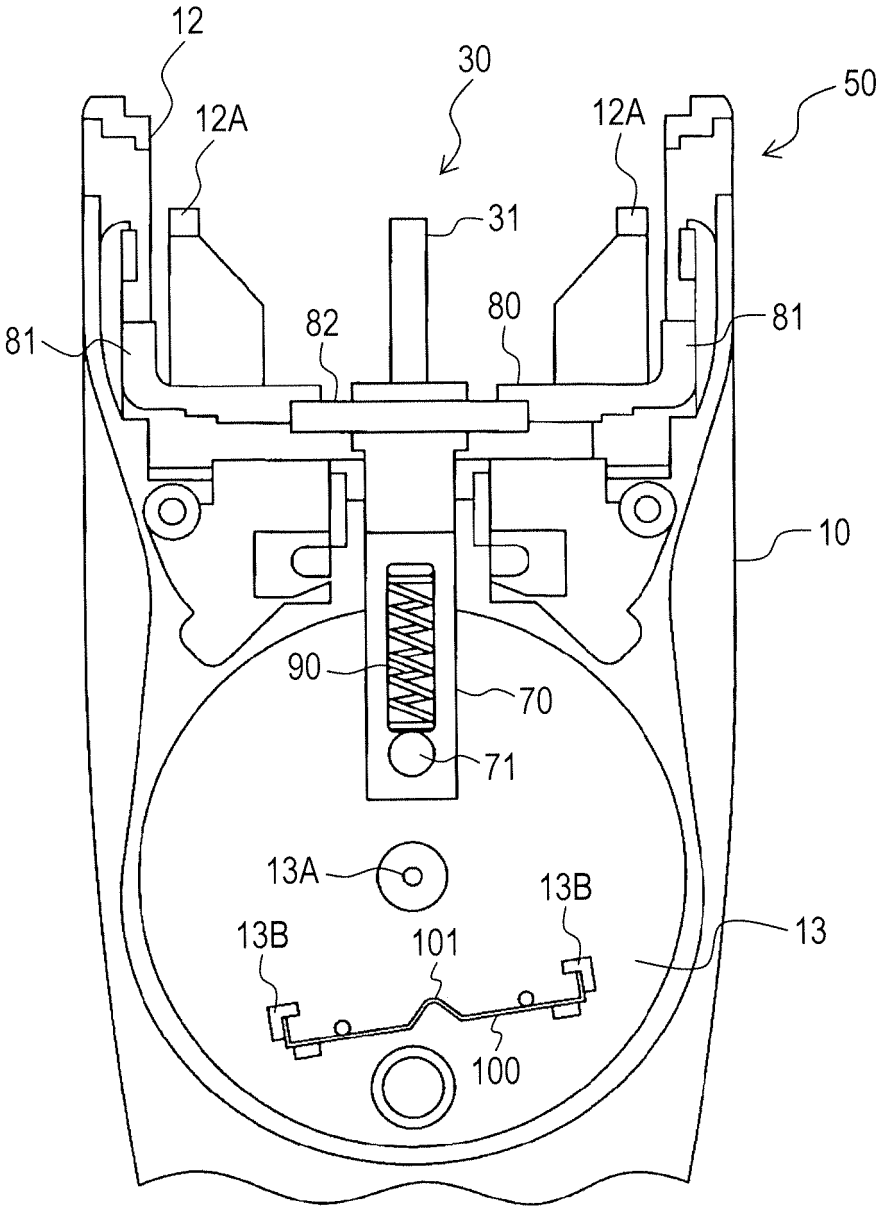


FIG. 3

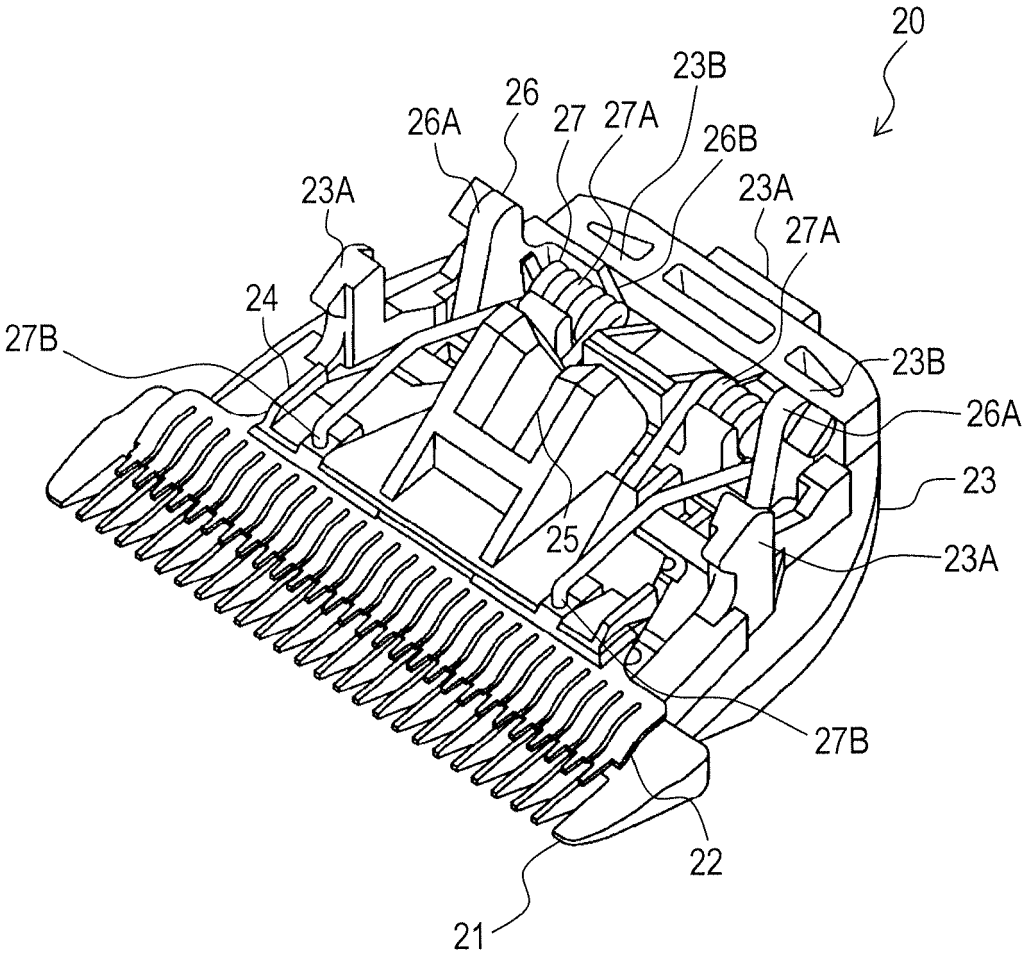

20
23B
26
26A
27
27A
26B
23A
23A
27A
24
27B
23B
26A
23
25
23A
27B
22
21

FIG. 4

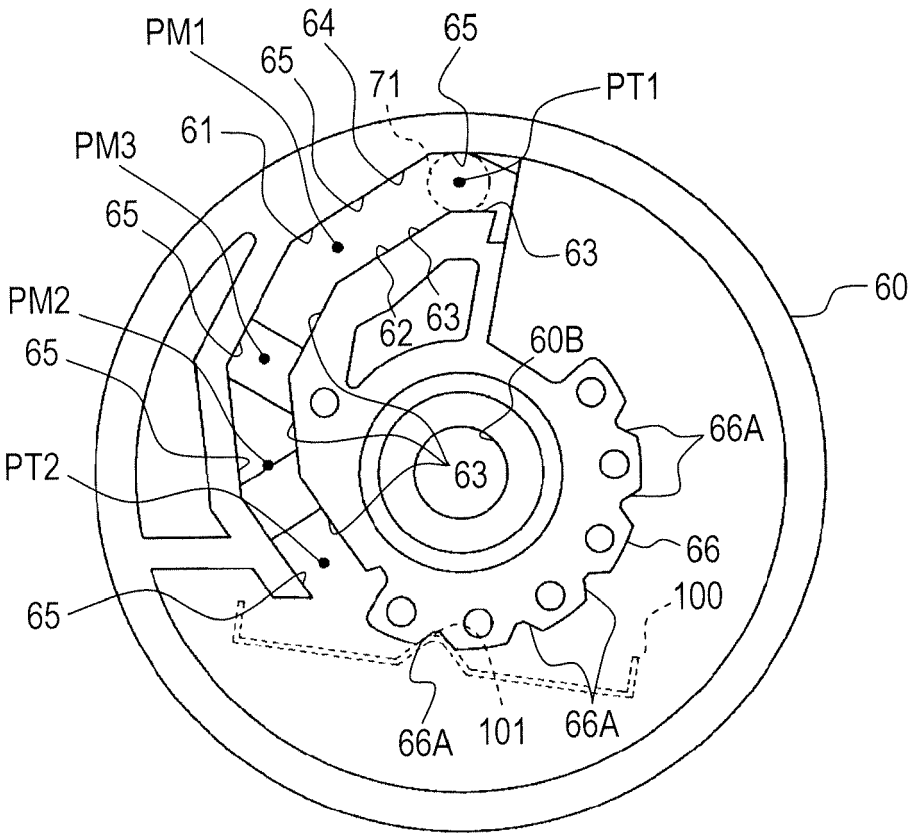

PM1
64
65
65
71
PT1
PM3
61
65
63
60
PM2
62
63
60B
65
66A
63
PT2
66
100
65
66A
101
66A

FIG. 5

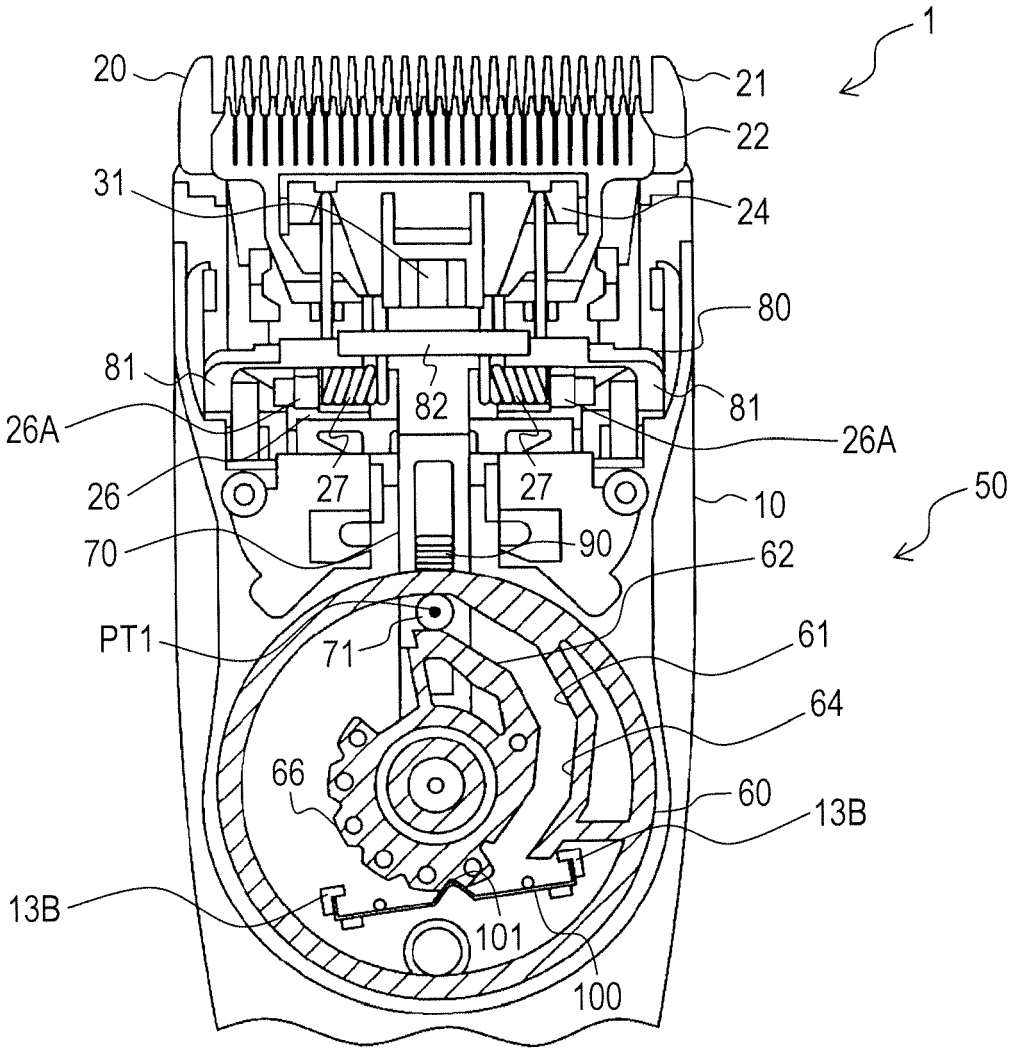

1
20
21
22
31
24
80
81
82
81
26A
26A
26
27
27
10
50
70
90
62
PT1
71
61
64
66
60
13B
13B
101
100

FIG. 6

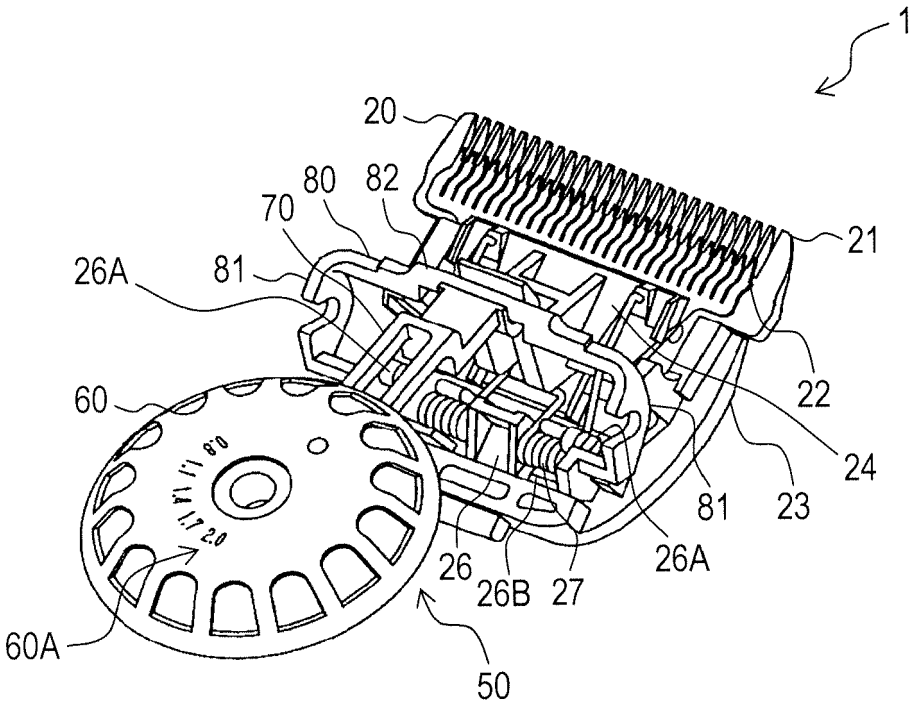


FIG. 7

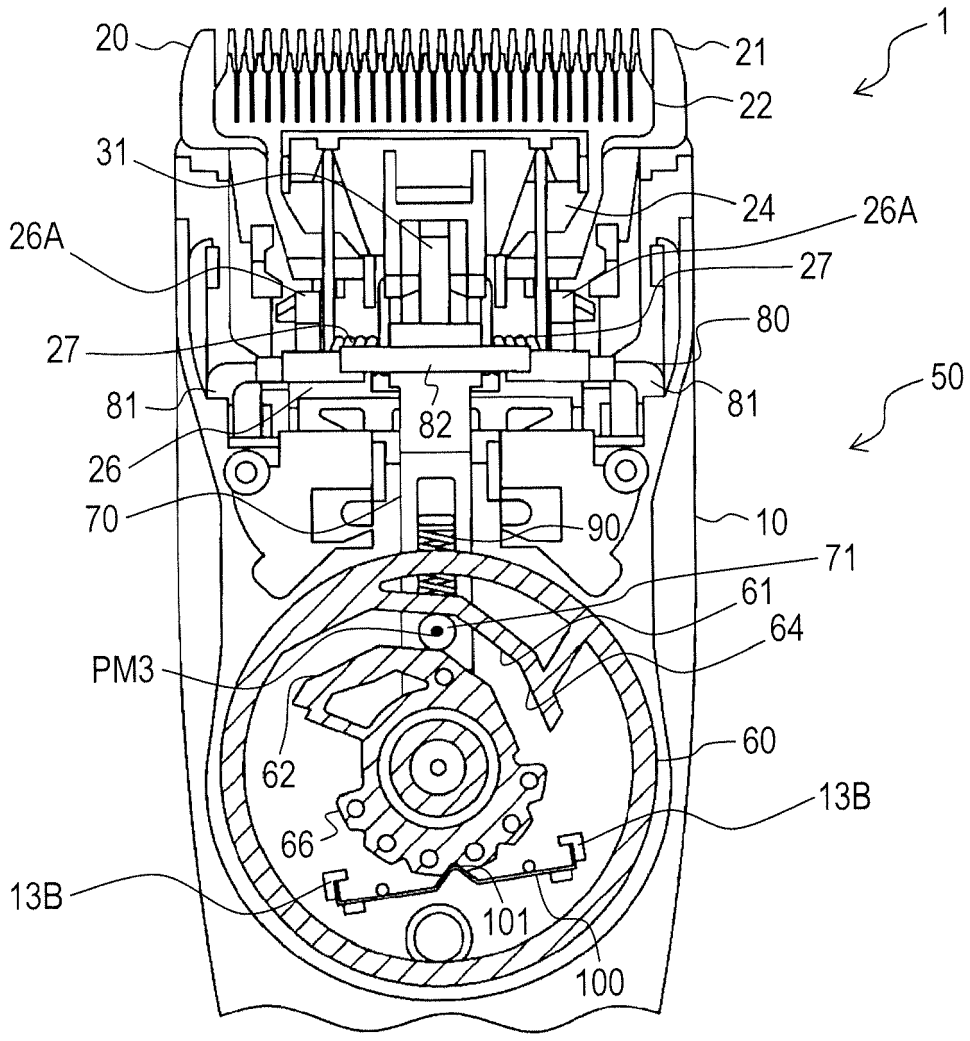

1
20
21
22
31
24
26A
26A
27
27
80
50
81
82
81
26
70
90
10
71
61
64
PM3
60
62
13B
66
13B
101
100

FIG. 8

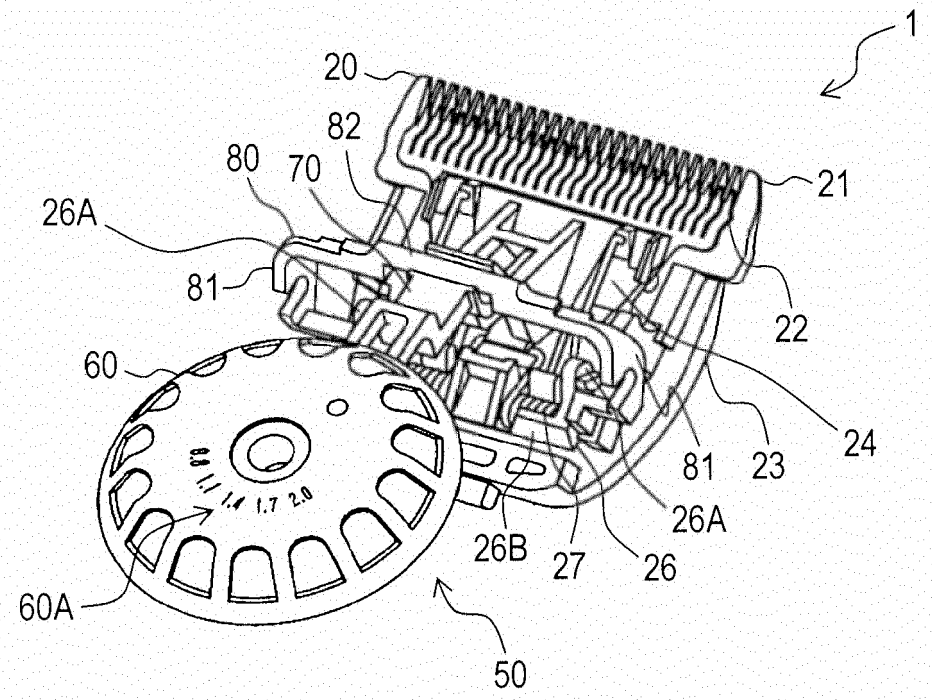


FIG. 9

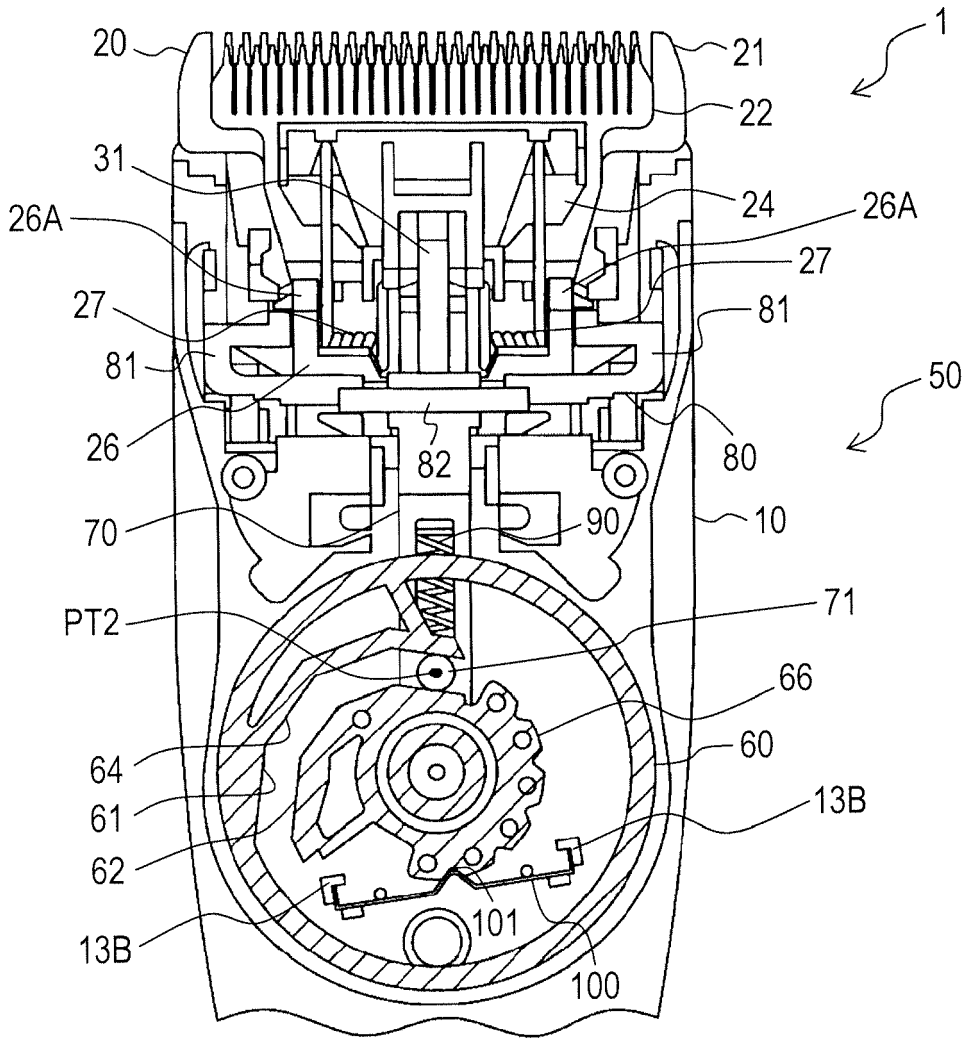

1
20
21
22
31
24
26A
26A
27
27
81
81
50
26
82
80
70
90
10
71
PT2
66
64
60
61
13B
62
101
13B
100

FIG. 10

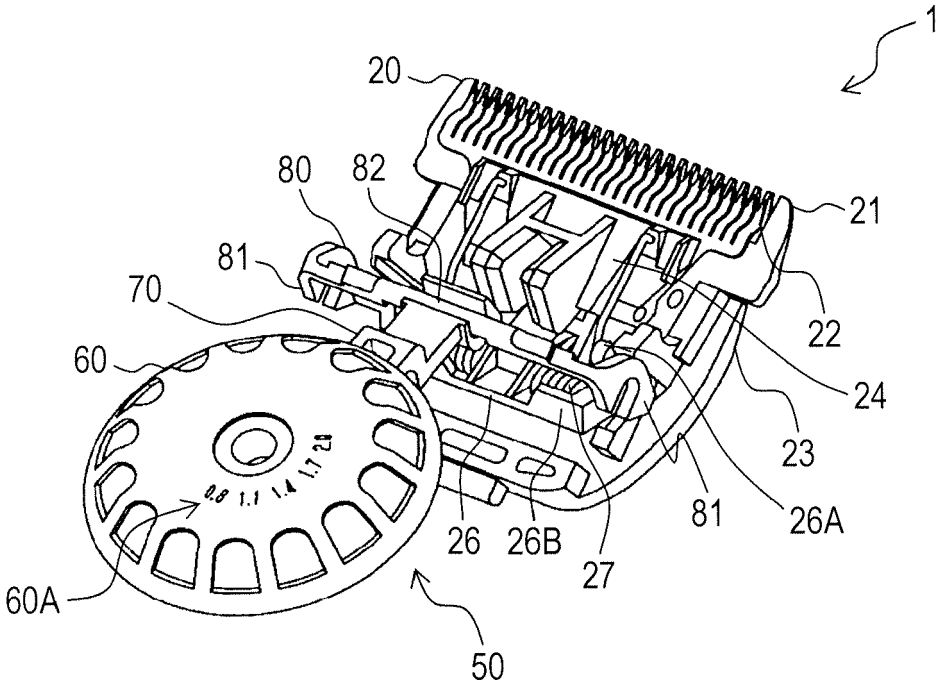


FIG. 11

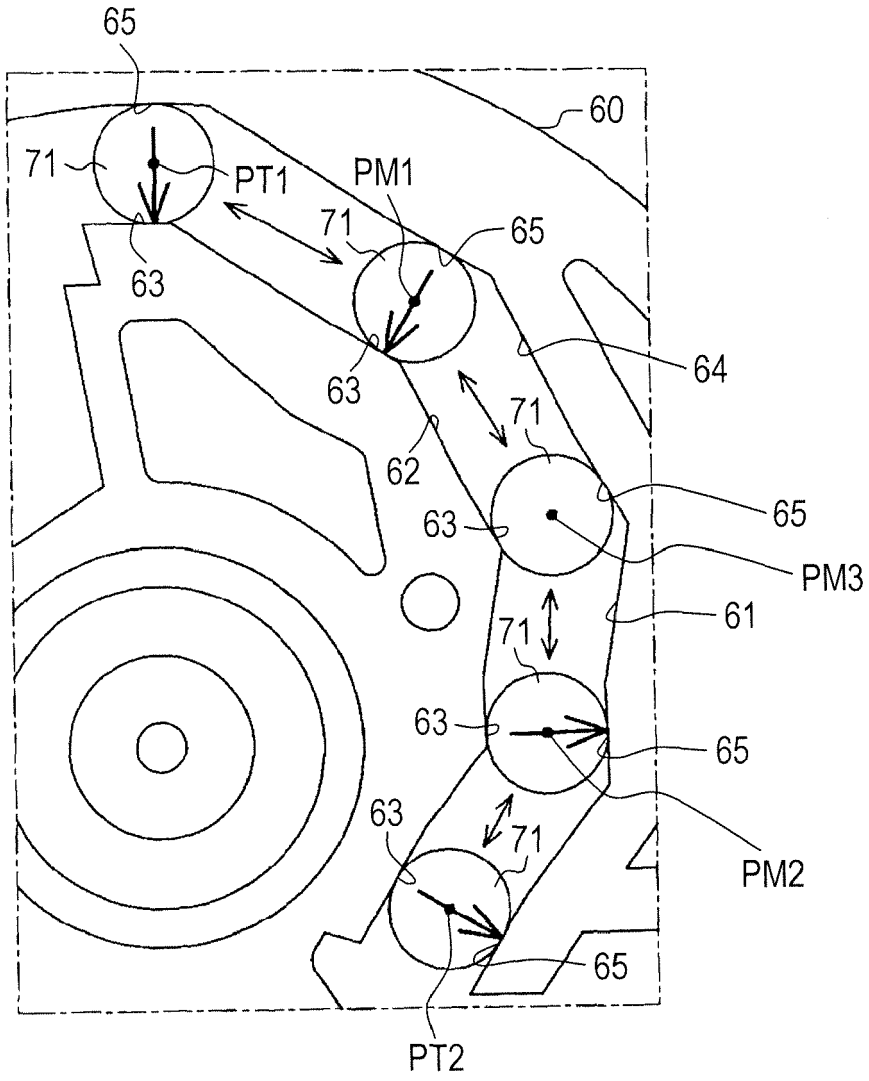
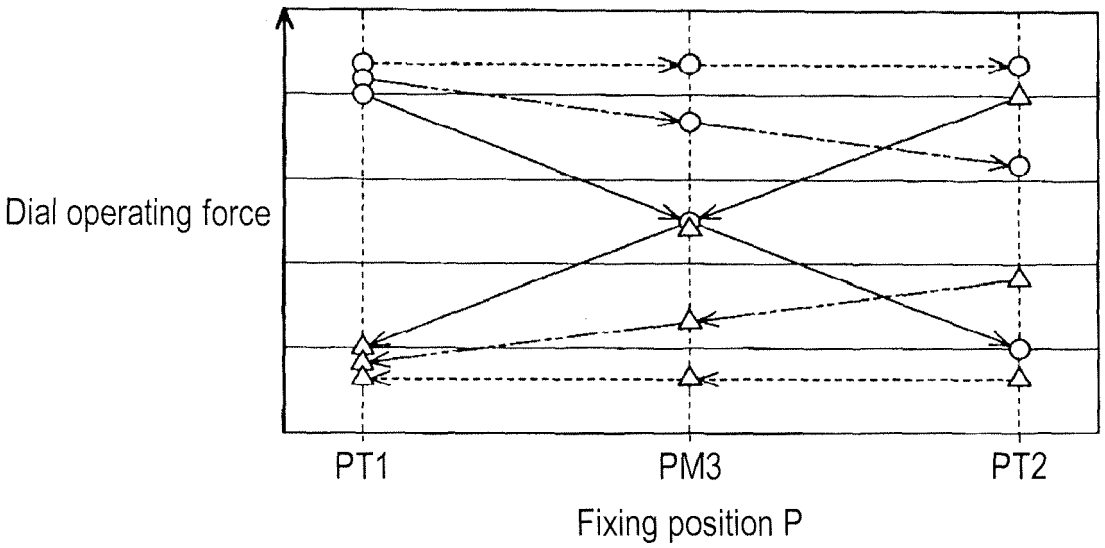

65
60
71
PT1
PM1
71
65
63
63
64
71
62
65
63
PM3
61
71
63
65
63
71
PM2
65
PT2

FIG. 12



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 15 3725

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 2005 304627 A (MATSUSHITA ELECTRIC WORKS LTD) 4 November 2005 (2005-11-04) * the whole document *	1-9	INV. B26B19/20
A	EP 1 757 413 A1 (MATSUSHITA ELECTRIC WORKS LTD [JP]) 28 February 2007 (2007-02-28) * paragraphs [0014], [0015]; figures 4A-9B *	1-9	
A	US 5 367 772 A (OGAWA HITOSHI [JP]) 29 November 1994 (1994-11-29) * column 4, line 44 - column 6, line 11; figures 3-5, 9, 10 *	1-9	
A	US 2007/107234 A1 (YAO WOODY [TW]) 17 May 2007 (2007-05-17) * paragraphs [0015] - [0023]; figures 1-6 *	1-9	
			TECHNICAL FIELDS SEARCHED (IPC) B26B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 August 2015	Rattenberger, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 15 3725

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-08-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005304627 A	04-11-2005	JP 4046098 B2	13-02-2008
		JP 2005304627 A	04-11-2005
EP 1757413 A1	28-02-2007	AT 526126 T	15-10-2011
		CN 1919547 A	28-02-2007
		CN 200974252 Y	14-11-2007
		EP 1757413 A1	28-02-2007
		JP 5074679 B2	14-11-2012
		JP 2007054545 A	08-03-2007
		KR 20070024371 A	02-03-2007
		US 2007044320 A1	01-03-2007
US 5367772 A	29-11-1994	DE 4317530 A1	02-12-1993
		US 5367772 A	29-11-1994
US 2007107234 A1	17-05-2007	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 4046098 B **[0002]**