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

(11) **EP 3 792 701 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.03.2021 Bulletin 2021/11

(51) Int Cl.:
G04B 27/00 *(2006.01)*

(21) Application number: **20195523.4**

(22) Date of filing: **10.09.2020**

(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
Designated Validation States:
KH MA MD TN

(30) Priority: **12.09.2019 JP 2019166504**

(71) Applicant: **Seiko Watch Kabushiki Kaisha**
Tokyo (JP)

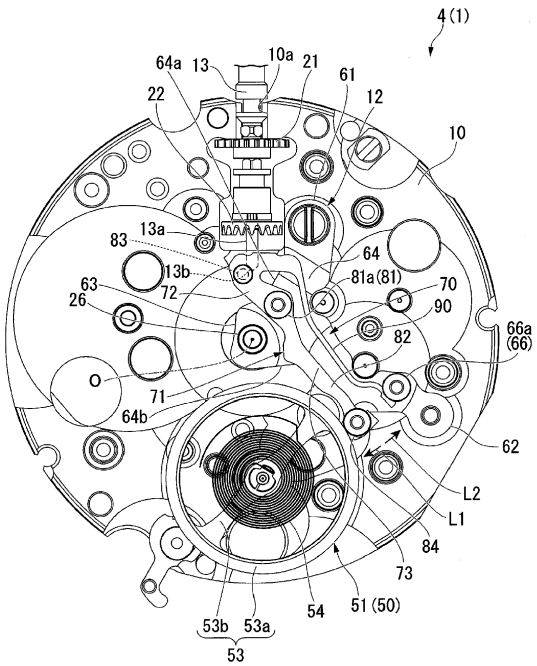
(72) Inventors:
- **NOMURA, Hiroshi**
  Chiba-shi, Chiba 261-8507 (JP)
- **SUZUKI, Shigeo**
  Chiba-shi, Chiba 261-8507 (JP)

(74) Representative: **Miller Sturt Kenyon**
9 John Street
London WC1N 2ES (GB)

(54) TRAIN WHEEL SETTING MECHANISM, TIMEPIECE MOVEMENT, AND TIMEPIECE

(57) A train wheel setting mechanism capable of preventing reduction in a design margin of a timepiece movement is provided. The train wheel setting mechanism includes a balance with hairspring 51 and a center wheel and pinion 32, a train wheel setting lever 71 that is provided so as to be capable of contacting with and separating from the balance with hairspring 51 and operates in conjunction with a winding stem, a main plate 10 supporting the balance with hairspring 51 and the center wheel and pinion 32, and a center wheel bridge 12 that supports the center wheel and pinion 32 with the main plate 10, and also supports the train wheel setting lever 71.

FIG. 6



EP 3 792 701 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a train wheel setting mechanism, a timepiece movement, and a timepiece.

2. Description of the Related Art

[0002] A mechanical timepiece in related art is provided with a train wheel setting mechanism that stops a second hand when adjusting time (for example, see JP-A-2006-234677). JP-A-2006-234677 discloses a configuration in which a balance setting lever for setting rotation of a balance with hairspring is provided so as to rotate based on rotation of a setting lever in a state where a second hand of a winding stem can be adjusted.

[0003] When a train wheel setting lever is disposed on a main plate by being supported by a pin fixed to the main plate, a part of a space on the main plate is occupied by the train wheel setting lever. Therefore, in order to avoid interference between parts, it is necessary to devise shapes of parts other than the train wheel setting lever, which reduces a design margin. This is more remarkable as a timepiece movement is smaller. Therefore, there is room for improvement in that in a train wheel setting mechanism in related art, reduction of the design margin of the timepiece movement is prevented.

SUMMARY OF THE INVENTION

[0004] It is an aspect of the present application to provide a train wheel setting mechanism capable of preventing reduction in a design margin of a timepiece movement, a timepiece movement including the train wheel setting mechanism, and a timepiece.

[0005] A train wheel setting mechanism of the application includes: a first rotating body and a second rotating body that are supported by a main plate; a train wheel setting lever that is provided to be capable of coming into contact with and separating from the first rotating body, and configured to operate in conjunction with a winding stem; and a bridge member that supports the second rotating body together with the main plate, and also supports the train wheel setting lever.

[0006] According to the application, the train wheel setting lever can be incorporated into a timepiece movement without providing a pin or the like for supporting the train wheel setting lever on the main plate. As a result, a degree of freedom in shapes of parts other than the train wheel setting lever is improved. Therefore, the train wheel setting mechanism capable of preventing reduction in a design margin of the timepiece movement can be provided.

[0007] In the train wheel setting mechanism described above, the second rotating body is a center wheel and pinion to which a minute hand is attached.

[0008] According to the application, the bridge member is disposed closer to the main plate than another bridge member that supports a rotating body to which a second hand is attached together with the main plate. Therefore, the bridge member is disposed closer to the winding stem than the other bridge member in a thickness direction of the main plate. Therefore, it becomes possible to easily design the configuration for operating the train wheel setting lever in conjunction with the winding stem.

[0009] In the train wheel setting mechanism described above, a biasing member configured to bias the train wheel setting lever with respect to the bridge member may be provided.

[0010] According to the application, the train wheel setting lever is pressed in one direction by the biasing member, so that rattling of the train wheel setting lever can be reduced and operations of the train wheel setting lever can be stabilized.

[0011] In the train wheel setting mechanism described above, the bridge member may be formed with a recess portion in which the train wheel setting lever and the biasing member are accommodated.

[0012] According to the application, a volume of a space occupied by the train wheel setting lever and the biasing member around the recess portion can be reduced as compared with a configuration in which the recess portion is not formed in the bridge member. As a result, a degree of freedom in shapes of parts other than the train wheel setting lever and the biasing member can be further improved.

[0013] In the train wheel setting mechanism described above, the biasing member may be provided integrally with the train wheel setting lever.

[0014] According to the application, the number of parts can be reduced as compared with a configuration in which the biasing member is provided as a member separate from the train wheel setting lever. As a result, a manufacturing cost can be reduced.

[0015] In the train wheel setting mechanism described above, the train wheel setting lever may include: a lever body that is supported by the bridge member; an abutting portion that is supported by the lever body and abuts against the winding stem by a biasing force of the biasing member; and a contacting portion that is supported by the lever body and is capable of coming into contact with the first rotating body.

[0016] According to the application, by displacing the winding stem in an axial direction, the abutting portion can be displaced together with the lever body according to a shape of the winding stem. As a result, the contacting portion supported by the lever body can come into contact with and be separated from the first rotating body. Therefore, the train wheel setting lever can be operated in conjunction with the winding stem.

[0017] In the train wheel setting mechanism described above, an interlocking portion that displaces in conjunc-

tion with displacement in an axial direction of the winding stem is included, and the train wheel setting lever may include: a lever body that is supported by the bridge member; an engaging portion that is supported by the lever body and is capable of engaging with the interlocking portion; and a contacting portion that is supported by the lever body and is capable of coming into contact with the first rotating body.

[0018] According to the application, by displacing the winding stem in the axial direction, the engaging portion can be displaced together with the lever body as the interlocking portion is displaced. As a result, the contacting portion supported by the lever body can come into contact with and be separated from the first rotating body. Therefore, the train wheel setting lever can be operated in conjunction with the winding stem.

[0019] In the train wheel setting mechanism described above, the train wheel setting lever may include an elastically deformable portion formed to be flexibly deformable.

[0020] According to the application, by flexibly deforming the elastically deformable portion, a contact pressure between the train wheel setting lever and the first rotating body can be reduced. Therefore, damage to the first rotating body from contact with the train wheel setting lever can be prevented.

[0021] Further, when the train wheel setting lever separates from the first rotating body, by restoration of the elastically deformable portion, the train wheel setting lever can flip the first rotating body and apply a rotational force to the first rotating body. As a result, an operation of the first rotating body can be promptly restarted.

[0022] In the train wheel setting mechanism described above, the train wheel setting lever may include the elastically deformable portion formed to be flexibly deformable, and the abutting portion abuts against the winding stem in a state in which the contacting portion is in contact with the first rotating body.

[0023] According to the application, since rotation of the lever body by the biasing member is restricted by contacting the abutting portion with the winding stem, only a restoring force due to flexible deformation of the elastically deformable portion can be applied to the first rotating body from the contacting portion. As a result, a contact pressure between the train wheel setting lever and the first rotating body can be reduced. Therefore, damage to the first rotating body from contact with the train wheel setting lever can be prevented.

[0024] Further, when the train wheel setting lever separates from the first rotating body, by restoration of the elastically deformable portion, the train wheel setting lever can flip the first rotating body and apply a rotational force to the first rotating body. As a result, an operation of the first rotating body can be promptly restarted.

[0025] In the train wheel setting mechanism described above, the train wheel setting lever is disposed on an opposite side of the main plate with the bridge member interposed therebetween.

[0026] According to the application, a space between the main plate and the bridge member can be prevented from being occupied by the train wheel setting lever. As a result, a degree of freedom in the shapes of the parts other than the train wheel setting lever, which are disposed between the main plate and the bridge member, can be improved.

[0027] In the train wheel setting mechanism described above, the train wheel setting lever may be disposed between the bridge member and the main plate.

[0028] According to the application, a space of the opposite side of the main plate with the bridge member interposed therebetween can be prevented from being occupied by the train wheel setting lever. As a result, a degree of freedom in shapes of parts other than the train wheel setting lever, which are disposed on the opposite side of the main plate with the bridge member interposed therebetween, can be improved.

[0029] A timepiece movement of the application includes the train wheel setting mechanism described above.

[0030] A timepiece of the application includes the timepiece movement described above.

[0031] According to the application, reduction in a design margin can be prevented. Therefore, the timepiece movement and the timepiece can be easily assembled and the manufacturing cost can be reduced. Further, a large number of parts can be disposed around the train wheel setting lever, and the multifunctional timepiece movement and the timepiece that have the large number of parts can be provided.

[0032] According to the application, a train wheel setting mechanism capable of preventing reduction in a design margin of a timepiece movement, a timepiece movement including the train wheel setting mechanism, and a timepiece can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033]

FIG. 1 is a plan view of a timepiece of a first embodiment.

FIG. 2 is a plan view of a movement according to the first embodiment when viewed from a front side.

FIG. 3 is a cross-sectional view taken along a line III-III in FIG. 2.

FIG. 4 is a plan view of a part of the movement according to the first embodiment when viewed from the front side.

FIG. 5 is a perspective view showing a center wheel bridge, a train wheel setting lever, and a biasing member according to the first embodiment.

FIG. 6 is a plan view of a part of the movement according to the first embodiment when viewed from the front side.

FIG. 7 is a plan view of a part of a movement according to a second embodiment when viewed from the

front side.

FIG. 8 is a plan view of a part of the movement according to the second embodiment when viewed from the front side.

FIG. 9 is a plan view of a part of a movement according to a third embodiment when viewed from the front side.

FIG. 10 is a cross-sectional view showing the movement according to the third embodiment.

FIG. 11 is a perspective view showing a center wheel bridge, a train wheel setting lever, and a biasing member according to the third embodiment.

FIG. 12 is a plan view of a part of a movement according to a fourth embodiment when viewed from the front side.

FIG. 13 is a cross-sectional view showing the movement according to the fourth embodiment.

FIG. 14 is a plan view of a part of a movement according to a fifth embodiment when viewed from the front side.

FIG. 15 is a cross-sectional view showing the movement according to the fifth embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] Hereinafter, embodiments of the present invention will be described by way of example only with reference to drawings. In the following description, configurations having the same or similar functions are denoted by the same reference numerals. Repeated description of these components may be omitted.

[First Embodiment]

[0035] The first embodiment will be described with reference to FIGS. 1 to 6.

[0036] FIG. 1 is a plan view of a timepiece of the first embodiment.

[0037] As shown in FIG. 1, a timepiece 1 of the present embodiment includes: a timepiece case 3 with a case back (not shown) and a glass 2, a movement 4 (timepiece movement), a dial 5 having indicators and the like, and an hour hand 6, a minute hand 7, and a second hand 8 that rotate around a central axis O to indicate the indicators on the dial 5.

[0038] The movement 4 is disposed in the timepiece case 3 between the dial 5 and the case back. Hereinafter, in a direction along the central axis O, a side (a side where the dial 5 is located) of the timepiece case 3 where the glass 2 is located with respect to the movement 4 is referred to as a "back side" of the movement 4. Further, in the direction along the central axis O, a side (a side opposite to the dial 5) of the timepiece case 3 where the case back is located with respect to the movement 4 is referred to as a "front side" of the movement 4. Further, the direction along the central axis O is referred to as a front-back direction.

[0039] FIG. 2 is a plan view of the movement according to the first embodiment as seen from the front side. FIG. 3 is a cross-sectional view taken along a line III-III in FIG. 2.

[0040] As shown in FIGS. 2 and 3, the movement 4 mainly includes: a main plate 10, a front train wheel 30 disposed on a front side of the main plate 10, a back train wheel 40 disposed on a back side of the main plate 10, a barrel and train wheel bridge 11 and a center wheel bridge 12 that support the front train wheel 30 together with the main plate 10, an escapement governor mechanism 50 that controls rotation of the front train wheel 30, and a train wheel setting mechanism 70 that sets a balance with hairspring 51, which will be described later, of the escapement governor mechanism 50.

[0041] As shown in FIG. 3, the main plate 10 constitutes a substrate of the movement 4. The main plate 10 is formed in a plate shape having a thickness in the front-back direction. The main plate 10 is disposed on a front side of the dial 5 (see FIG. 1). The barrel and train wheel bridge 11 and the center wheel bridge 12 are disposed on the front side of the main plate 10. The barrel and train wheel bridge 11 and the center wheel bridge 12 are separately fixed to the main plate 10. The center wheel bridge 12 is disposed closer to the main plate 10 than the barrel and train wheel bridge 11. The center wheel bridge 12 is formed so as to entirely overlap the main plate 10 when viewed from the front side. The center wheel bridge 12 is formed so that at least a part thereof overlaps with the barrel and train wheel bridge 11 when viewed from the front side. A detailed configuration of the center wheel bridge 12 will be described later.

[0042] FIG. 4 is a plan view of a part of the movement according to the first embodiment as seen from the front side.

[0043] As shown in FIG. 4, a winding stem guide hole 10a is formed in the main plate 10. A winding stem 13 is incorporated in the winding stem guide hole 10a. The winding stem 13 is supported by the main plate 10 so as to be rotatable and movable in an axial direction of the winding stem 13. The winding stem 13 extends around an axis perpendicular to the central axis O. The winding stem 13 includes a cylindrical portion 13a extending in the axial direction of the winding stem 13 with a constant outer diameter, and a conical portion 13b that includes a tip end on a center side of the movement 4 and gradually decreases in diameter from the cylindrical portion 13a toward the center side of the movement 4. Cross-sectional shapes of the cylindrical portion 13a and the conical portion 13b are circular shapes around a central axis of the winding stem 13. A crown 9 is connected to the winding stem 13 on an outer side of the timepiece case 3 shown in FIG. 1. The winding stem 13 is axially displaceable as the crown 9 is pulled out. The winding stem 13 is held at a predetermined position by a switching device described later. In the present embodiment, the winding stem 13 is held in at least two positions, that is, a zeroth-step position entering most inside the movement 4 and a first-step position in which the crown 9 is pulled by one

step from the zeroth-step position. In addition, in FIG. 4, the winding stem 13 is located at the zeroth-step position.

[0044] The switching device includes a setting lever and a yoke (not shown). The setting lever and the yoke are provided so as to be separately rotatable with respect to the main plate 10. The setting lever engages with the winding stem 13 and rotates in conjunction with displacement in the axial direction of the winding stem 13. The yoke is engaged with the setting lever and rotates with rotation of the setting lever. The setting lever and the yoke slide with each other as the winding stem 13 is displaced in the axial direction. In a sliding portion of the setting lever and the yoke, an engaging portion that removably engages one of the setting lever and the yoke with another is provided. The engaging portion engages the setting lever and the yoke with each other in a state where the winding stem 13 is located at each of the zeroth-step position and the first-step position. As a result, the winding stem 13 is held at each of the zeroth-step position and the first-step position.

[0045] A winding pinion 21 and a clutch wheel 22 are assembled on the winding stem 13. The winding pinion 21 and the clutch wheel 22 are disposed at positions closer to an outer side of the movement 4 than the cylindrical portion 13a. The winding pinion 21 is provided so as to be displaceable in the axial direction with respect to the winding stem 13. The winding pinion 21 is provided so as not to be displaceable in the axial direction of the winding stem 13 with respect to the main plate 10. The winding pinion 21 is provided so as not to rotate with the winding stem 13 at the zeroth-step position and to rotate with the winding stem 13 at the first-step position. A crown wheel 23 meshes with the winding pinion 21 (see FIG. 2). The clutch wheel 22 is disposed on the center side of the movement 4 with respect to the winding pinion 21. The clutch wheel 22 has teeth protruding to the center side of the movement 4. The clutch wheel 22 is provided so as to be displaceable in the axial direction with respect to the winding stem 13 and not rotatable with respect to the winding stem 13. The clutch wheel 22 engages with the yoke and is displaced in the axial direction of the winding stem 13 with rotation of the yoke. Specifically, the clutch wheel 22 is displaced in a direction opposite to a displacement direction of the winding stem 13 with respect to the main plate 10 in conjunction with the displacement in the axial direction of the winding stem 13. The clutch wheel 22 is located at a predetermined position in the axial direction in a state where the winding stem 13 is at the zeroth-step position. The clutch wheel 22 is located at a meshing position closer to the center side of the movement 4 than the predetermined position in the axial direction in a state where the winding stem 13 is at the first-step position. The clutch wheel 22 meshes with a minute wheel 43 (see FIG. 2) at the meshing position.

[0046] As shown in FIG. 2, the front train wheel 30 includes a movement barrel 31, a center wheel and pinion 32, a third wheel and pinion 33, a second wheel and pinion 34, and a center second pinion arbor 35. The movement barrel 31 is disposed on one side with respect to the central axis of the winding stem 13 when viewed from the front side. The center wheel and pinion 32 and the center second pinion arbor 35 are disposed coaxially with the central axis O. Most of the third wheel and pinion 33 is disposed on an opposite side to the movement barrel 31 with respect to the central axis of the winding stem 13 when viewed from the front side. That is, most of the third wheel and pinion 33 and the movement barrel 31 are disposed on opposite sides of the central axis of the winding stem 13 when viewed from the front side. Put another way, the movement barrel 31 is disposed on the opposite side of the central axis of the winding stem 13 to most of the third wheel and pinion 33. The entire second wheel and pinion 34 is disposed on the same side as the most of the third wheel and pinion 33 with respect to the central axis of the winding stem 13 when viewed from the front side.

[0047] As shown in FIG. 3, the movement barrel 31 is rotatably supported by the main plate 10 and the barrel and train wheel bridge 11. At least a part of the movement barrel 31 is disposed at the same position as the center wheel bridge 12 in the front-back direction. The movement barrel 31 includes a barrel arbor 31a, a barrel 31b supported by the barrel arbor 31a so as to be relatively rotatable, and a barrel tooth part 31c protruding from an outer peripheral surface of the barrel 31b. A tip end of a front side of the barrel arbor 31a is pivotally supported by the barrel and train wheel bridge 11 via a jeweled bush held by the barrel and train wheel bridge 11. A tip end of a back side of the barrel arbor 31a is pivotally supported by the main plate 10 via a jeweled bush held by the main plate 10. The barrel 31b is disposed between the main plate 10 and the barrel and train wheel bridge 11. The barrel 31b accommodates a mainspring (not shown). A tip end of an inner peripheral side of the mainspring is engaged with the barrel arbor 31a. A tip end of an outer peripheral side of the mainspring is engaged with an inner side of the barrel 31b. The barrel tooth part 31c is provided closer to the main plate 10 than the center wheel bridge 12 in the front-back direction.

[0048] A ratchet wheel 36 is assembled on the barrel arbor 31a. The ratchet wheel 36 is disposed on a front side of the barrel 31b. The ratchet wheel 36 is provided on the barrel arbor 31a so as to not be relatively rotatable. The ratchet wheel 36 rotates via transmission gears (partly not shown) of the crown wheel 23 and the like by rotation of the winding pinion 21 described above (see FIG. 2). By rotating the ratchet wheel 36, the barrel arbor 31a rotates with respect to the barrel 31b, and the mainspring is wound up. The barrel 31b rotates by using power when the mainspring is unwound as a power source.

[0049] The center wheel and pinion 32 is rotatably supported by the main plate 10 and the center wheel bridge 12. The center wheel and pinion 32 includes a center arbor 32a and a center wheel 32b assembled on the center arbor 32a. The center arbor 32a is formed in a cylin-

drical shape and extends in the front-back direction around the central axis O. A tip end of a front side of the center arbor 32a is pivotally supported by the center wheel bridge 12 via a jeweled bush 26 held by the center wheel bridge 12. An intermediate portion of the center arbor 32a in the front-back direction is pivotally supported by the center wheel bridge 12 via the jeweled bush held by the main plate 10. The center arbor 32a protrudes out of the back side of the main plate 10. A center pinion 32c is formed in a part of the center arbor 32a located between the main plate 10 and the center wheel bridge 12. The center pinion 32c meshes with the barrel tooth part 31c of the movement barrel 31. As a result, the center wheel and pinion 32 is rotated by the power of the movement barrel 31. The center wheel 32b is disposed between the main plate 10 and the center wheel bridge 12. The center wheel 32b is adjacent to a back side of the center pinion 32c. A part of the center wheel 32b overlaps with the movement barrel 31 when viewed from the front side.

[0050] The third wheel and pinion 33 is rotatably supported by the main plate 10 and the barrel and train wheel bridge 11. The third wheel and pinion 33 includes a third arbor 33a and a third wheel 33b assembled on the third arbor 33a. The third arbor 33a extends in the front-back direction. A tip end of a front side of the third arbor 33a is pivotally supported by the barrel and train wheel bridge 11. A tip end of a back side of the third arbor 33a is pivotally supported by the main plate 10. The third arbor 33a has a third pinion (not shown) that meshes with the center wheel 32b. As a result, the third wheel and pinion 33 is rotated by the power of the movement barrel 31. The third wheel 33b is disposed between the barrel and train wheel bridge 11 and the center wheel bridge 12. The third wheel 33b overlaps with the center wheel bridge 12 when viewed from the front side.

[0051] The second wheel and pinion 34 is rotatably supported by the main plate 10 and the barrel and train wheel bridge 11. The second wheel and pinion 34 includes a second arbor 34a and a second wheel 34b assembled on the second arbor 34a. The second arbor 34a extends in the front-back direction. A tip end of a front side of the second arbor 34a is pivotally supported by the barrel and train wheel bridge 11. A tip end of a back side of the second arbor 34a is pivotally supported by the main plate 10. The second arbor 34a has a second pinion 34c that meshes with the third wheel 33b. As a result, the second wheel and pinion 34 is rotated by the power of the movement barrel 31. The second wheel 34b is disposed closer to the main plate 10 than the third wheel 33b. At least a part of the second wheel 34b is disposed at the same position as the center wheel bridge 12 in the front-back direction.

[0052] The center second pinion arbor 35 extends in the front-back direction around the central axis O. The center second pinion arbor 35 is inserted into an inside of the center arbor 32a. A tip end of a front side of the center second pinion arbor 35 is pivotally supported by the barrel and train wheel bridge 11 via a jeweled bush held by the barrel and train wheel bridge 11. An intermediate portion of the center second pinion arbor 35 in the front-back direction is supported on an inner peripheral surface of the center arbor 32a so as to be relatively rotatable. The second hand 8 is attached to a tip end of a back side of the center second pinion arbor 35. The center second pinion arbor 35 has a center second pinion 35a. The center second pinion 35a is disposed between the barrel and train wheel bridge 11 and the center wheel bridge 12. The center second pinion 35a meshes with the third wheel 33b. As a result, the center second pinion arbor 35 is rotated by the power of the movement barrel 31.

[0053] The back train wheel 40 includes a cannon pinion 41, an hour wheel 42, and the minute wheel 43.

[0054] The cannon pinion 41 is formed in a tubular shape as a whole, and is disposed coaxially with the central axis O. The cannon pinion 41 is disposed on the back side of the main plate 10 and is assembled on an outside of the center arbor 32a in a slippable manner. The cannon pinion 41 is rotated by the power of the movement barrel 31. At a tip end of a front side of the cannon pinion 41, teeth that mesh with the minute wheel 43 are provided. The cannon pinion 41 rotates while slipping with respect to the center wheel and pinion 32 in accordance with rotation of the winding stem 13 located at the first-step position. The minute hand 7 is attached to a tip end of a back side of the cannon pinion 41.

[0055] The hour wheel 42 is formed in the tubular shape as a whole, and is disposed coaxially with the central axis O. The hour wheel 42 is assembled on an outside of the cannon pinion 41 so as to be relatively rotatable. At a tip end of a front side of the hour wheel 42, teeth are provided. The hour hand 6 is attached to a tip end of a back side of the hour wheel 42.

[0056] The minute wheel 43 is rotatably supported by the main plate 10. The minute wheel 43 meshes with the teeth of the cannon pinion 41 and the teeth of the hour wheel 42, and decelerates and transmits rotation of the cannon pinion 41 to the hour wheel 42. As a result, the hour wheel 42 is rotated by the power of the movement barrel 31.

[0057] The escapement governor mechanism 50 includes an escape wheel and pinion and a pallet fork (both not shown), and the balance with hairspring 51. The escape wheel and pinion meshes with the second wheel 34b and rotates by the power transmitted from the movement barrel 31. The pallet fork escapes the escape wheel and pinion to be rotated regularly. The balance with hairspring 51 reciprocally rotates at a constant cycle to swing the pallet fork. The escapement governor mechanism 50 controls the rotation of the front train wheel 30 by regular vibration of the balance with hairspring 51.

[0058] The balance with hairspring 51 is disposed on an opposite side to the winding stem 13 with the central axis O interposed therebetween when viewed from the front side. The balance with hairspring 51 is disposed at a position where it does not overlap with the movement

barrel 31, the third wheel and pinion 33 and the second wheel and pinion 34 when viewed from the front side. The balance with hairspring 51 includes a balance staff 52, a balance wheel 53, and a hairspring 54. The balance with hairspring 51 uses power of the hairspring 54 to reciprocally rotate around a central axis of the balance staff 52 at a constant vibration cycle. The balance staff 52 is a rod-shaped member extending in the front-back direction. The balance staff 52 is pivotally supported by the main plate 10 and a balance bridge (not shown). The balance staff 52 is press-fitted into a fitting hole of the balance wheel 53 and fixed to the balance wheel 53. The balance wheel 53 includes an annular rim portion 53a that surrounds the balance staff 52 from an outside in a radial direction, and an arm portion 53b that connects the rim portion 53a and the balance staff 52 in the radial direction. The rim portion 53a is disposed coaxially with the balance staff 52. An outer peripheral surface of the rim portion 53a has a constant outer diameter. The hairspring 54 is formed in a spiral shape in a plane perpendicular to the central axis of the balance staff 52. An inner tip end of the hairspring 54 is fixed to the balance staff 52. An outer tip end of the hairspring 54 is fixedly disposed with respect to the main plate 10.

[0059] The train wheel setting mechanism 70 sets the balance with hairspring 51 by utilizing a switching operation performed on a position in the axial direction of the winding stem 13. The train wheel setting mechanism 70 includes the balance with hairspring 51, the center wheel and pinion 32 and the center wheel bridge 12, which are described above, a train wheel setting lever 71 that is provided so as to be capable of contacting and separating from the balance with hairspring 51 and operates in conjunction with the winding stem 13, and a biasing member 90 that biases the train wheel setting lever 71 against the center wheel bridge 12.

[0060] FIG. 5 is a perspective view showing the center wheel bridge, the train wheel setting lever, and the biasing member according to the first embodiment.

[0061] As shown in FIGS. 4 and 5, the center wheel bridge 12 is formed in the plate shape having a thickness in the front-back direction. A front surface and a back surface of the center wheel bridge 12 respectively extend along a plane perpendicular to the front-back direction. The center wheel bridge 12 includes a first fixing portion 61 and a second fixing portion 62 that are fixed to the main plate 10. The first fixing portion 61 is disposed between the winding stem 13 and the second wheel and pinion 34 when viewed from the front side. The second fixing portion 62 is closer to the first fixing portion 61 than the central axis of the winding stem 13 when viewed from the front side, and is disposed on an opposite side to the first fixing portion 61 with the second wheel and pinion 34 interposed therebetween in a circumferential direction around the central axis O. When viewed from the front side, the center wheel bridge 12 extends from the first fixing portion 61 to the second fixing portion 62 through the center side of the movement 4 with respect to the second wheel and pinion 34. A jeweled bush holding portion 63 that holds the jeweled bush 26 is formed between the first fixing portion 61 and the second fixing portion 62 among the center wheel bridge 12. The jeweled bush holding portion 63 is disposed along the central axis O. The jeweled bush holding portion 63 is separated from the main plate 10 and the barrel and train wheel bridge 11 in the front-back direction (see FIG. 3). The jeweled bush holding portion 63 is formed with a through hole for holding the jeweled bush 26.

[0062] A recess portion 64 and a pin hole 65 (see FIG. 3) are formed in the center wheel bridge 12. The recess portion 64 is formed on the front surface of the center wheel bridge 12 and is recessed towards the back side. The recess portion 64 is formed in a part of the center wheel bridge 12 excluding the first fixing portion 61, the second fixing portion 62, and the jeweled bush holding portion 63. The recess portion 64 is formed to have a substantially constant depth. A bottom surface of the recess portion 64 is located on the back side relative to the balance wheel 53 of the balance with hairspring 51 (see FIG. 3). The recess portion 64 includes a first opening portion 64a and a second opening portion 64b that open to a side surface of the center wheel bridge 12. The first opening portion 64a is formed between the first fixing portion 61 and the jeweled bush holding portion 63, and faces the tip end on the center side of the movement 4 in the winding stem 13 when viewed from the front side. The second opening portion 64b is formed between the second fixing portion 62 and the jeweled bush holding portion 63, and faces the balance with hairspring 51 when viewed from the front side. As shown in FIG. 3, the pin hole 65 penetrates the center wheel bridge 12 in the front-back direction and opens at the bottom surface of the recess portion 64. The pin hole 65 is formed in a circular cross section shape.

[0063] As shown in FIGS. 4 and 5, a locking portion 66 for locking the biasing member 90 described later is disposed in the recess portion 64 of the center wheel bridge 12. The locking portion 66 protrudes from the bottom surface of the recess portion 64 to the front side. The locking portion 66 is formed in a cylindrical shape. The locking portion 66 is a pin that is a member separate from the center wheel bridge 12, and is press-fitted into a hole formed in the center wheel bridge 12. The locking portion 66 is formed with a flange 66a that protrudes in a direction orthogonal to the front-back direction on the front side of the bottom surface of the recess portion 64.

[0064] The train wheel setting lever 71 is disposed on an opposite side to the main plate 10 with the center wheel bridge 12 interposed therebetween. The train wheel setting lever 71 is disposed in the recess portion 64 of the center wheel bridge 12. The train wheel setting lever 71 is rotatably supported by the center wheel bridge 12. A rotation center of the train wheel setting lever 71 is located closer to the first fixing portion 61 and the second fixing portion 62 than the central axis of the winding stem 13 when viewed from the front side. The train wheel

setting lever 71 includes a first arm 72 and a second arm 73 extending from the rotation center. The first arm 72 protrudes out of the center wheel bridge 12 through the first opening portion 64a of the recess portion 64. The first arm 72 is formed so as to be capable of abutting against the winding stem 13. The first arm 72 rotates in conjunction with the displacement in the axial direction of the winding stem 13. The second arm 73 protrudes out of the center wheel bridge 12 through the second opening portion 64b of the recess portion 64. The second arm 73 is formed to be contactable from an upstream side in a first direction L1 around the rotation center to an outer peripheral surface of the balance wheel 53 of the balance with hairspring 51. The second arm 73 rotates in conjunction with rotation of the first arm 72. A distance from the rotation center to a contact part between the second arm 73 and the balance with hairspring 51 is longer than a distance from the rotation center to a contact part between the first arm 72 and the winding stem 13.

[0065] Specifically, the train wheel setting lever 71 has a following configuration. The train wheel setting lever 71 includes a support pin 81 held by the center wheel bridge 12, a lever body 82 supported by the center wheel bridge 12 via the support pin 81, and an abutting portion 83 and a contacting portion 84 supported by the lever body 82. The support pin 81 is formed in the cylindrical shape. The support pin 81 is press-fitted into the pin hole 65 of the center wheel bridge 12 from the front side. The support pin 81 is formed with a flange 81a that protrudes in the direction orthogonal to the front-back direction on the front side of the bottom surface of the recess portion 64. In the present embodiment, the support pin 81 is formed in the same manner as the locking portion 66 provided on the center wheel bridge 12. The support pin 81 holds the lever body 82 between the bottom surface of the recess portion 64 and the flange 81a.

[0066] The lever body 82 is formed of a plate material having a thickness in the front-back direction. The lever body 82 is rotatably supported by the support pin 81. The lever body 82 is disposed along the bottom surface of the recess portion 64. The lever body 82 is formed thinner than the depth of the recess portion 64. A part of the lever body 82 that overlaps with the center wheel bridge 12 when viewed from the front side is disposed so as not to protrude to the front side from the front surface of the center wheel bridge 12. The lever body 82 extends out of the center wheel bridge 12 from each of the first opening portion 64a and the second opening portion 64b of the recess portion 64, and forms a part of each of the first arm 72 and the second arm 73.

[0067] The abutting portion 83 is supported by the lever body 82 on the first arm 72. The abutting portion 83 is a member separate from the lever body 82, and is assembled on the lever body 82 at a tip end portion of the first arm 72. The abutting portion 83 is formed in the cylindrical shape, and disposed so as to protrude from the lever body 82 to the back side. The abutting portion 83 faces an outer peripheral surface of the winding stem 13 from the upstream side in the first direction L1. The abutting portion 83 displaces together with the lever body 82 in conjunction with the displacement in the axial direction of the winding stem 13.

[0068] The contacting portion 84 is supported by the lever body 82 on the second arm 73. At least a part of the contacting portion 84 is disposed at the same position as the balance wheel 53 of the balance with hairspring 51 in the front-back direction. The contacting portion 84 is a member separate from the lever body 82, and is assembled to the lever body 82 at a tip end portion of the second arm 73. The contacting portion 84 is formed in the cylindrical shape, and disposed so as to protrude from the lever body 82 to the front side. The contacting portion 84 faces the outer peripheral surface of the balance wheel 53 of the balance with hairspring 51 from the upstream side in the first direction L1. The contacting portion 84 contacts and separates from the balance wheel 53 of the balance with hairspring 51 as the lever body 82 is displaced.

[0069] The biasing member 90 biases the train wheel setting lever 71 toward the center wheel bridge 12 in the first direction L1. The biasing member 90 is integrally formed of the same member as the lever body 82 of the train wheel setting lever 71. That is, the biasing member 90 and the lever body 82 are formed of a single plate material. The biasing member 90 is a cantilever beam extending from the lever body 82. A base end of the biasing member 90 is coupled to the lever body 82 in the second arm 73 of the train wheel setting lever 71 at an outer side of the center wheel bridge 12 when viewed from the front side. The biasing member 90 enters an inside of the recess portion 64 from a coupled part with the lever body 82 through the first opening portion 64a. The biasing member 90 contacts with an outer peripheral surface of the locking portion 66 in the recess portion 64 from an upstream side in a second direction L2 opposite to the first direction L1. An entire part of a tip end portion of the biasing member 90 from an intersection part with the first opening portion 64a is disposed in the recess portion 64.

[0070] Next, operations of the train wheel setting mechanism 70 will be described with reference to FIGS. 4 and 6.

[0071] FIG. 6 is a plan view of a part of the movement according to the first embodiment when viewed from the front side, and shows the state where the winding stem 13 is at the first-step position.

[0072] When the winding stem 13 is at the zeroth-step position, as shown in FIG. 4, the abutting portion 83 of the train wheel setting lever 71 faces an outer peripheral surface of the cylindrical portion 13a of the winding stem 13 from the upstream side in the first direction L1. At this time, the train wheel setting lever 71 is biased in the first direction L1 by the biasing member 90. Therefore, the abutting portion 83 is abutted against the winding stem 13 by a biasing force of the biasing member 90. When

the abutting portion 83 is abutted against the cylindrical portion 13a of the winding stem 13, the contacting portion 84 of the train wheel setting lever 71 is separated from the balance wheel 53 of the balance with hairspring 51 on the upstream side in the first direction L1.

[0073] When the winding stem 13 is displaced from the zeroth-step position to the first-step position (FIG. 6), the conical portion 13b of the winding stem 13 is disposed on a downstream side of the abutting portion 83 in the first direction L1. Then, the lever body 82 biased in the first direction L1 by the biasing member 90 rotates in the first direction L1, so that the abutting portion 83 is brought close to the central axis of the winding stem 13. In the shown example, the abutting portion 83 does not contact with the winding stem 13 in the first-step position, but may contact with the conical portion 13b of the winding stem 13 in the first-step position. When the lever body 82 rotates in the first direction L1, the contacting portion 84 approaches and contacts the outer peripheral surface of the balance wheel 53.

[0074] When the winding stem 13 is displaced from the first-step position to the zeroth-step position, the lever body 82 rotates in the second direction L2 so as to separate the abutting portion 83 from the central axis of the winding stem 13 while resisting the biasing force of the biasing member 90. When the lever body 82 rotates in the second direction L2, the contacting portion 84 separates from the outer peripheral surface of the balance wheel 53.

[0075] As a result, the train wheel setting mechanism 70 sets the balance with hairspring 51 by utilizing the switching operation performed on the position in the axial direction of the winding stem 13.

[0076] As described above, the train wheel setting mechanism 70 of the present embodiment includes the train wheel setting lever 71 that operates in conjunction with the winding stem 13, and the center wheel bridge 12 that supports the center wheel and pinion 32 together with the main plate 10, and also supports the train wheel setting lever 71.

[0077] According to this configuration, the train wheel setting lever 71 can be incorporated into the movement 4 without providing a pin or the like for supporting the train wheel setting lever 71 on the main plate 10. As a result, a degree of freedom in shapes of parts other than the train wheel setting lever 71 is improved. Therefore, the train wheel setting mechanism 70 capable of preventing reduction in a design margin of the movement 4 can be provided.

[0078] In addition, the minute hand 7 is attached to the center wheel and pinion 32 supported by the center wheel bridge 12.

[0079] According to this configuration, the center wheel bridge 12 is disposed closer to the main plate 10 than the barrel and train wheel bridge 11 that supports the center second pinion arbor 35 to which the second hand 8 is attached together with the main plate 10. Therefore, the center wheel bridge 12 is disposed closer to the winding stem 13 than the barrel and train wheel bridge 11 in the front-back direction. Therefore, it becomes possible to easily design the configuration for operating the train wheel setting lever 71 in conjunction with the winding stem 13.

[0080] Further, the train wheel setting mechanism 70 includes the biasing member 90 that biases the train wheel setting lever 71 toward the center wheel bridge 12.

[0081] According to this configuration, the train wheel setting lever 71 is pressed in one direction by the biasing member 90, so that rattling of the train wheel setting lever 71 can be reduced and the operation of the train wheel setting lever 71 can be stabilized.

[0082] In addition, the center wheel bridge 12 is formed with the recess portion 64 for accommodating the train wheel setting lever 71 and the biasing member 90.

[0083] According to this configuration, a volume of a space occupied by the train wheel setting lever 71 and the biasing member 90 around the recess portion 64 can be reduced as compared with a configuration in which a recess portion is not formed in a center wheel bridge. As a result, a degree of freedom in shapes of parts other than the train wheel setting lever 71 and the biasing member 90 can be further improved.

[0084] Further, the biasing member 90 is provided integrally with the train wheel setting lever 71.

[0085] According to this configuration, the number of parts can be reduced as compared with a configuration in which a biasing member is provided as a member separate from a train wheel setting lever. As a result, a manufacturing cost can be reduced.

[0086] In addition, the train wheel setting lever 71 includes the lever body 82 supported by the center wheel bridge 12, the abutting portion 83 that is supported by the lever body 82 and abuts against the winding stem 13 by the biasing force of the biasing member 90, and the contacting portion 84 that is supported by the lever body 82 and is capable of contacting the balance with hairspring 51.

[0087] According to this configuration, by displacing the winding stem 13 in the axial direction, the abutting portion 83 can be displaced together with the lever body 82 according to a shape of the winding stem 13. As a result, the contacting portion 84 supported by the lever body 82 can come into contact with and be separated from the balance with hairspring 51. Therefore, the train wheel setting lever 71 can be operated in conjunction with the winding stem 13.

[0088] Further, the train wheel setting lever 71 is disposed on the opposite side to the main plate 10 with the center wheel bridge 12 interposed therebetween.

[0089] According to this configuration, a space between the main plate 10 and the center wheel bridge 12 can be prevented from being occupied by the train wheel setting lever 71. As a result, the degree of freedom in the shapes of the parts other than the train wheel setting lever 71 and the biasing member 90, which are disposed between the main plate 10 and the center wheel bridge

12, can be improved.

[0090] Further, since the movement 4 and the timepiece 1 of the present embodiment are provided with the train wheel setting mechanism 70 described above, the reduction in the design margin is prevented. Therefore, the movement 4 and the timepiece 1 can be easily assembled and the manufacturing cost can be reduced. Further, a large number of parts can be disposed around the train wheel setting lever 71, and the movement 4 and the timepiece 1 having multiple functions can be provided.

[0091] In the present embodiment, the biasing member 90 is locked to the locking portion 66 that protrudes into the recess portion 64 of the center wheel bridge 12, but for example, the center wheel bridge may be formed such that the biasing member is locked to a side wall surface of the recess portion 64.

[Second Embodiment]

[0092] Next, the second embodiment is described with reference to FIG. 7. In the first embodiment, the contacting portion 84 of the train wheel setting lever 71 is provided as the member separate from the lever body 82. In contrast, the second embodiment differs from the first embodiment in that a contacting portion 184 of a train wheel setting lever 171 is provided as a same member as a lever body 182. Further, the second embodiment is different from the first embodiment in that a second arm 173 is formed so as to be flexibly deformable. A configuration other than that described below is the same as that of the first embodiment.

[0093] FIG. 7 is a plan view of a part of a movement according to the second embodiment when viewed from the front side, and shows the state where the winding stem 13 is at the zeroth-step position.

[0094] As shown in FIG. 7, the lever body 182 extends in the second arm 173 of the train wheel setting lever 171 with a width similar to that of the biasing member 90 when viewed from the front side, and is formed so as to be flexibly deformable. The contacting portion 184 is integrally formed of the same member as the lever body 182. The contacting portion 184 is formed by bending a plate material forming the lever body 182 toward a front side at a tip end of the second arm 173. The contacting portion 184 is formed to be in line contact with the outer peripheral surface of the balance wheel 53 of the balance with hairspring 51.

[0095] FIG. 8 is a plan view of a part of the movement according to the second embodiment when viewed from the front side, and shows the state where the winding stem 13 is at the first-step position.

[0096] As shown in FIG. 8, when the winding stem 13 is at the first-step position, the abutting portion 83 comes into contact with the conical portion 13b of the winding stem 13 from the upstream side in the first direction L1. The contacting portion 184 comes into contact with the outer peripheral surface of the balance wheel 53. At this time, the lever body 182 is flexibly deformed in the second arm 173 of the train wheel setting lever 171. A torque in the second direction L2 generated by the lever body 182 is smaller than a torque in the first direction L1 generated by the biasing member 90. In this embodiment, the abutting portion 83 is in contact with the winding stem 13 from the upstream side in the first direction L1, so transmission of the biasing force of the biasing member 90 to the balance with hairspring 51 via the contacting portion 184 is restricted. However, this is not essential.

[0097] According to the second embodiment as described above, in addition to operational effects same as the first embodiment, following operational effects can be achieved.

[0098] In the present embodiment, the train wheel setting lever 171 includes the second arm 173 formed so as to be flexibly deformable. The abutting portion 83 abuts against the winding stem 13 in a state where the contacting portion 184 is in contact with the balance with hairspring 51.

[0099] According to this configuration, since rotation of the lever body 182 by the biasing member 90 is restricted by bringing the abutting portion 83 into contact with the winding stem 13, only a restoring force due to flexible deformation of the second arm 173 can be applied to the balance with hairspring 51 from the contacting portion 184. As a result, a contact pressure between the train wheel setting lever 171 and the balance with hairspring 51 can be reduced. Therefore, damage to the balance with hairspring 51 due to contact with the train wheel setting lever 171 can be prevented.

[0100] Also, when the train wheel setting lever 171 separates from the balance with hairspring 51, by restoration of the second arm 173, the train wheel setting lever 171 can flip the balance with hairspring 51 and apply a rotational force to the balance with hairspring 51. As a result, an operation of the balance with hairspring 51 can be promptly restarted.

[Third Embodiment]

[0101] Next, the third embodiment will be described with reference to FIGS. 9 to 11. In the first embodiment, the wheel setting lever 71 is rotatably supported by the center wheel bridge 12. In contrast, the third embodiment differs from the first embodiment in that a train wheel setting lever 271 is supported by the center wheel bridge 12 so as to be movable in parallel. A configuration other than that described below is the same as that of the first embodiment.

[0102] FIG. 9 is a plan view of a part of a movement according to the third embodiment when viewed from the front side.

[0103] As shown in FIG. 9, the recess portion 64 of the center wheel bridge 12 has a first recess portion 267 and a second recess portion 268. The second recess portion 268 is formed deeper than the first recess portion 267 (also see FIG. 11). The entire second recess portion 268

is formed on an inner side of the first recess portion 267 when viewed from the front side. The first recess portion 267 and the second recess portion 268 are respectively formed with a constant depth. The second recess portion 268 includes the first opening portion 64a and the second opening portion 64b.

[0104] A lever guide pin 266 is disposed on the center wheel bridge 12 instead of the locking portion 66 of the first embodiment. A pair of the lever guide pins 266 is provided. The lever guide pin 266 protrudes from a bottom surface of the second recess portion 268 to the front side. The pair of lever guide pins 266 is disposed side by side in the axial direction of the winding stem 13. The lever guide pin 266 is formed in the cylindrical shape. In the present embodiment, the lever guide pin 266 is formed of a member separate from the center wheel bridge 12, and is press-fitted into a hole formed in the center wheel bridge 12. The lever guide pin 266 is formed so as not to protrude to the front side beyond the front surface of the center wheel bridge 12 and to protrude to the front side beyond the bottom surface of the first recess portion 267.

[0105] FIG. 10 is a cross-sectional view showing the movement according to the third embodiment. FIG. 11 is a perspective view showing the center wheel bridge, the train wheel setting lever, and a biasing member according to the third embodiment. Note that in FIG. 11, for convenience, a biasing member 290 is shown by a virtual line.

[0106] As shown in FIGS. 10 and 11, a train wheel setting mechanism 270 includes the train wheel setting lever 271 and the biasing member 290.

[0107] The train wheel setting lever 271 is disposed in the second recess portion 268 of the center wheel bridge 12. A part of the train wheel setting lever 271 that overlaps with the center wheel bridge 12 when viewed from the front side is disposed so as not to protrude to the front side beyond the bottom surface of the first recess portion 267 of the center wheel bridge 12. The train wheel setting lever 271 is supported by the center wheel bridge 12 so as to be displaceable in the axial direction of the winding stem 13. The train wheel setting lever 271 protrudes from the second recess portion 268 beyond the outside of the center wheel bridge 12 through the first opening portion 64a and the second opening portion 64b. The train wheel setting lever 271 is formed so as to engage with a member that is displaced in conjunction with the displacement in the axial direction of the winding stem 13, and is capable of contacting the outer peripheral surface of the balance wheel 53 of the balance with hairspring 51.

[0108] Specifically, the train wheel setting lever 271 has a following configuration. The train wheel setting lever 271 includes a lever body 282 supported by the center wheel bridge 12, and an engaging portion 283 and a contacting portion 284 supported by the lever body 282.

[0109] The lever body 282 is formed of a plate material having a thickness in the front-back direction. The lever body 282 is disposed along the bottom surface of the second recess portion 268. The lever body 282 is formed thinner than a depth of the second recess portion 268 with respect to the bottom surface of the first recess portion 267. A guide hole 285 into which the pair of lever guide pins 266 is inserted is formed in the lever body 282. The guide hole 285 extends in the axial direction of the winding stem 13. The guide hole 285 and the lever guide pin 266 allow the lever body 282 to move in parallel with the center wheel bridge 12 in the axial direction of the winding stem 13, and meanwhile, a movement range in the axial direction of the winding stem 13 of the lever body 282 with respect to the center wheel bridge 12 is defined.

[0110] The lever body 282 includes a base portion 286 having the guide hole 285 formed therein and an arm 287 extending from the base portion 286. The base portion 286 extends in the axial direction of the winding stem 13. A first tip end 286a of the base portion 286 is formed so as to be capable of protruding to the outside of the center wheel bridge 12 through the second opening portion 64b. The arm 287 extends from an intermediate portion of the base portion 286. The arm 287 protrudes to the outside of the center wheel bridge 12 through the first opening portion 64a. In the shown example, the pair of guide holes 285 is formed so that the lever guide pins 266 are inserted therein one by one, but only one guide hole 285 may be formed so that the pair of lever guide pins 266 is inserted together.

[0111] The engaging portion 283 engages with the clutch wheel 22. The engaging portion 283 is formed so as to be capable of contacting the teeth of the clutch wheel 22 from the center side of the movement 4. The engaging portion 283 is integrally formed of the same member as the lever body 282. The engaging portion 283 is formed by bending a plate material forming the lever body 282 toward the front side at a tip end of the arm 287.

[0112] As shown in FIG. 9, an intermediate portion of the engaging portion 283 viewed from the front side intersects with the central axis of the winding stem 13, and extends in a direction orthogonal to the axial direction of the winding stem 13. Both tip ends of the engaging portion 283 when viewed from the front side extend in a direction away from the teeth of the clutch wheel 22 as a distance from the central axis of the winding stem 13 when viewed from the front side is increased. As a result, an edge of the engaging portion 283 is prevented from coming into contact with the teeth of the clutch wheel 22.

[0113] As shown in FIGS. 10 and 11, at least a part of the contacting portion 284 is disposed at the same position as the balance wheel 53 of the balance with hairspring 51 in the front-back direction. The contacting portion 284 is formed so as to be capable of contacting the balance wheel 53 from the winding stem 13 side. The contacting portion 284 is integrally formed of the same member as the lever body 282. The contacting portion 284 is formed by bending the plate material forming the lever body 282 toward the front side at the first tip end

286a of the base portion 286. The contacting portion 284 has a connection portion with the base portion 286 as a base end, and extends in the direction orthogonal to the axial direction of the winding stem 13 when viewed from the front side. The contacting portion 284 is formed so as to be flexibly deformable.

[0114] As shown in FIG. 9, the biasing member 290 biases the train wheel setting lever 271 toward the center wheel bridge 12 in a direction in which the engaging portion 283 abuts against the clutch wheel 22. The biasing member 290 is disposed in the recess portion 64 of the center wheel bridge 12. A part of the biasing member 290 that overlaps with the center wheel bridge 12 when viewed from the front side is disposed so as not to protrude to the front side beyond the front surface of the center wheel bridge 12. The biasing member 290 includes a supported portion 291 supported by the center wheel bridge 12, and a spring portion 292 extending from the supported portion 291. The supported portion 291 is formed of a plate material having a thickness in the front-back direction. The supported portion 291 is disposed so as to overlap the first recess portion 267 and the second recess portion 268 when viewed from the front side. The supported portion 291 is disposed along the bottom surface of the first recess portion 267 and a front surface of the lever body 282 of the train wheel setting lever 271. The supported portion 291 is formed thinner than a depth of the first recess portion 267. A hole into which the lever guide pin 266 is press-fitted is formed in the supported portion 291. As a result, the supported portion 291 is fixed to the center wheel bridge 12.

[0115] The spring portion 292 is a cantilever beam extending from the supported portion 291. Substantially the entire spring portion 292, excluding a tip end portion, overlaps the first recess portion 267 when viewed from the front side. The spring portion 292 protrudes to the outside of the center wheel bridge 12 through the first opening portion 64a. A tip end of the spring portion 292 is located at the outside the center wheel bridge 12 and is bent toward the back side. The tip end of the spring portion 292 is in contact with the first end portion 286a of the base portion 286 of the lever body 282.

[0116] Next, operations of the train wheel setting mechanism 270 will be described.

[0117] When the winding stem 13 is at the zeroth-step position, the engaging portion 283 of the train wheel setting lever 271 preferably abuts against the teeth of the clutch wheel 22 located at a predetermined position in the axial direction of the winding stem 13 from the center side of the movement 4. At this time, the contacting portion 284 is separated from the balance wheel 53 of the balance with hairspring 51 toward the winding stem 13 side.

[0118] When the winding stem 13 is displaced from the zeroth-step position to the first-step position, the clutch wheel 22 is displaced from the predetermined position toward the center side of the movement 4. Then, the engaging portion 283 is displaced toward the center side of the movement 4 as the clutch wheel 22 is moved. As a result, the train wheel setting lever 271 biased by the biasing member 290 is displaced in the axial direction of the winding stem 13 while resisting the biasing force of the biasing member 290. The contacting portion 284 approaches and contacts the outer peripheral surface of the balance wheel 53 as the engaging portion 283 moves toward the center side of the movement 4. At this time, the contacting portion 284 may be flexibly deformed.

[0119] When the winding stem 13 is displaced from the first-step position to the zeroth-step position, the clutch wheel 22 is displaced toward the outside of the movement 4. Since the biasing member 290 biases the train wheel setting lever 271 in the direction in which the engaging portion 283 abuts against the clutch wheel 22, the train wheel setting lever 271 displaces toward the outside of the movement 4 as the clutch wheel 22 is displaced. Then, the contacting portion 284 separates from the outer peripheral surface of the balance wheel 53.

[0120] According to the third embodiment as described above, in addition to the operational effects same as the first embodiment, following operational effects can be achieved.

[0121] In the present embodiment, the train wheel setting lever 271 includes the lever body 282 supported by the center wheel bridge 12, the engaging portion 283 supported by the lever body 282 and formed to be engageable with the clutch wheel 22, and the contacting portion 284 supported by the lever body 282 and capable of contacting the balance with hairspring 51.

[0122] According to this configuration, by displacing the winding stem 13 in the axial direction, the engaging portion 283 can be displaced together with the lever body 282 as the clutch wheel 22 is displaced. As a result, the contacting portion 284 supported by the lever body 282 can come into contact with and be separated from the balance with hairspring 51. Therefore, the train wheel setting lever 271 can be operated in conjunction with the winding stem 13.

[0123] Further, the train wheel setting lever 271 includes the contacting portion 284 formed so as to be flexibly deformable.

[0124] According to this configuration, by flexibly deforming the contacting portion 284, a contact pressure between the train wheel setting lever 271 and the balance with hairspring 51 can be reduced. Therefore, damage to the balance with hairspring 51 due to contact with the train wheel setting lever 271 can be prevented.

[Fourth Embodiment]

[0125] Next, the fourth embodiment will be described with reference to FIGS. 12 to 13. In the first embodiment, the support pin 81 of the train wheel setting lever 71 is press-fitted into the center wheel bridge 12. In contrast, the fourth embodiment differs from the first embodiment in that a support pin 381 of the train wheel setting lever 71 is attached to the center wheel bridge 12 by a screw

connection. A configuration other than that described below is the same as that of the first embodiment.

[0126] FIG. 12 is a plan view of a part of a movement according to the fourth embodiment when viewed from the front side. FIG. 13 is a cross-sectional view showing the movement according to the fourth embodiment.

[0127] As shown in FIGS. 12 and 13, the support pin 381 includes a screw socket 385 inserted from the back side into the pin hole 65 of the center wheel bridge 12, and a screw 386 screwed into the screw socket 385. The screw socket 385 is formed in a cylindrical shape extending in the front-back direction, and has a thread cut on an inner peripheral surface. The screw socket 385 protrudes from the bottom surface of the recess portion 64 of the center wheel bridge 12 to the front side. The lever body 82 of the train wheel setting lever 71 is mounted on an outer peripheral surface of the screw socket 385. At a tip end on the back side of the screw socket 385, a flange portion that fits in a spot of the pin hole 65 is provided. The screw 386 is screwed into the screw socket 385 from the front side. A head portion of the screw 386 protrudes radially outward beyond the outer peripheral surface of the screw socket 385. The support pin 381 holds the lever body 82 between the bottom surface of the recess portion 64 and the head portion of the screw 386.

[0128] According to the fourth embodiment as described above, in addition to the operational effects same as the first embodiment, following operational effects can be achieved.

[0129] In the present embodiment, the support pin 381 holds the lever body 82 between the head portion of the screw 386 and the center wheel bridge 12.

[0130] According to this configuration, the lever body 82 can be easily removed from the center wheel bridge 12 as compared with a configuration in which the lever body 82 is held with the center wheel bridge 12 by the support pin press-fitted into the center wheel bridge 12. Therefore, a train wheel setting mechanism 370 having excellent maintainability can be provided.

[Fifth Embodiment]

[0131] Next, the fifth embodiment will be described with reference to FIGS. 14 to 15. In the second embodiment, the train wheel setting lever 171 is disposed on the opposite side to the main plate 10 with the center wheel bridge 12 interposed therebetween. In contrast, the fifth embodiment differs from the second embodiment in that a train wheel setting lever 471 is disposed between a center wheel bridge 412 and the main plate 10. A configuration other than that described below is the same as that of the second embodiment. The same changes can be made to the first and other embodiments.

[0132] FIG. 14 is a plan view of a part of a movement according to the fifth embodiment when viewed from the front side. FIG. 15 is a cross-sectional view showing the movement according to the fifth embodiment.

[0133] As shown in FIGS. 14 and 15, the center wheel bridge 412 is formed substantially symmetrically with the front and back of the center wheel bridge 12 of the second embodiment. A recess portion 464 of the center wheel bridge 412 is formed on a back surface of the center wheel bridge 412 and is recessed towards the front side.

[0134] The train wheel setting lever 471 includes a lever body 482 supported by the center wheel bridge 412 via the support pin 81, and an abutting portion 483 and a contacting portion 484 supported by the lever body 482. A part of the lever body 482 that overlaps with the center wheel bridge 412 when viewed from the back side is disposed so as not to protrude to the back side beyond a back surface of the center wheel bridge 412. The lever body 482 is formed to be flexibly deformable. The abutting portion 483 is disposed to protrude from the lever body 482 to the back side. The contacting portion 484 is disposed at an outside of the center wheel bridge 412. At least a part of the contacting portion 484 is disposed at the same position as the balance wheel 53 of the balance with hairspring 51 in the front-back direction. The contacting portion 484 is integrally formed of the same member as the lever body 482. The contacting portion 484 is formed by bending a plate material forming the lever body 482 toward a front side at a tip end of the second arm 173.

[0135] A base end of a biasing member 490 is coupled to the lever body 482 at a position overlapping the center wheel bridge 412 when viewed from the back side. The entire biasing member 490 is disposed in the recess portion 464.

[0136] According to the fifth embodiment as described above, in addition to the operational effects same as the second embodiment, following operational effects can be achieved.

[0137] In the present embodiment, the train wheel setting lever 471 is disposed between the center wheel bridge 412 and the main plate 10.

[0138] According to this configuration, a space on the opposite side to the main plate 10 with the center wheel bridge 412 interposed therebetween can be prevented from being occupied by the train wheel setting lever 471. As a result, a degree of freedom in shapes of parts other than the train wheel setting lever 471 and the biasing member 490, which are disposed on the opposite side to the main plate 10 with the center wheel bridge 412 interposed therebetween, can be improved.

[0139] The invention is not limited to the above-described embodiments described with reference to the drawings, and various modifications can be considered within the technical scope thereof.

[0140] For example, in the above-mentioned embodiments, a bridge member that supports the train wheel setting lever is the center wheel bridge, but the invention is not limited thereto. For example, the barrel and train wheel bridge that supports a rotating body such as the movement barrel 31, the third wheel and pinion 33, the second wheel and pinion 34, and the center second pin-

ion arbor 35 together with the main plate 10 may support the train wheel setting lever.

[0141] Further, in the above-mentioned embodiments, the center wheel and pinion 32 is supported by the center wheel bridge 12 via the jeweled bush 26 held by the center wheel bridge 12, but the configuration for supporting the center wheel and pinion by the center wheel bridge is not limited thereto. For example, the center wheel and pinion may be supported by the center wheel bridge by being assembled on an outer peripheral side of a pipe supported by the center wheel bridge.

[0142] In the above-mentioned embodiments, the train wheel setting lever is formed so as to be capable of contacting the balance wheel 53 of the balance with hairspring 51 on the outside of the center wheel bridge when viewed from the front side. However, the train wheel setting lever may be formed so as to be capable of contacting with the balance wheel at a position overlapping the center wheel bridge when viewed from the front side.

[0143] Further, in the third embodiment described above, parallel movement of the lever body 282 with respect to the center wheel bridge 12 is guided by the pair of lever guide pins 266 provided on the center wheel bridge 12, and the guide hole 285 provided on the train wheel setting lever 271. However, the mechanism for guiding the parallel movement of the lever body with respect to the center wheel bridge is not limited thereto. For example, the lever guide pin may be formed in a shape extending in a moving direction of the lever body when viewed from the front side. For example, the parallel movement of the lever body with respect to the center wheel bridge may be guided by the lever body slidingly contacting a side wall surface of the recess portion of the center wheel bridge.

[0144] Further, in the third embodiment, the train wheel setting lever 271 is engaged with the clutch wheel 22 by the biasing member 290 biasing the train wheel setting lever 271. However, the present invention is not limited to this. For example, without using the biasing member, by engaging the train wheel setting lever with the clutch wheel in a non-separable manner, the train wheel setting lever may be configured to be displaced in conjunction with the displacement of the clutch wheel. The train wheel setting lever may be engaged with a member that is displaced in conjunction with the displacement in the axial direction of the winding stem 13, and may be engaged with, for example, the setting lever or the yoke.

[0145] In addition, it is possible to appropriately replace components in the above-described embodiments with known components without departing from the scope of the present invention, and each embodiment and each modification mentioned above may be suitably combined. For example, the first embodiment may be combined with the third embodiment, and the train wheel setting lever may be engaged with a member that is displaced in conjunction with the displacement in the axial direction of the winding stem 13.

Claims

1. A train wheel setting mechanism (70) comprising:

   a first rotating body (50) and a second rotating body (32) that are supported by a main plate (10);
   a train wheel setting lever (71) that is provided to be capable of coming into contact with and separating from the first rotating body (50), and configured to operate in conjunction with a winding stem (13); and
   a bridge member (12) that supports the second rotating body (32) together with the main plate (10), and also supports the train wheel setting lever (71).

2. The train wheel setting mechanism according to claim 1, wherein
   the second rotating body is a center wheel and pinion (32) to which a minute hand (7) is attached.

3. The train wheel setting mechanism according to claim 1 or 2, further comprising:
   a biasing member (90) configured to bias the train wheel setting lever (71) with respect to the bridge member (12).

4. The train wheel setting mechanism according to claim 3, wherein
   the bridge member is formed with a recess portion (64) in which the train wheel setting lever (71) and the biasing member (90) are accommodated.

5. The train wheel setting mechanism according to claim 3 or 4, wherein
   the biasing member (90) is provided integrally with the train wheel setting lever (71).

6. The train wheel setting mechanism according to any one of claims 3 to 5, wherein the train wheel setting lever includes:

   a lever body (82) that is supported by the bridge member (12);
   an abutting portion (83) that is supported by the lever body (82) and abuts against the winding stem (13) by a biasing force of the biasing member (90); and
   a contacting portion (84) that is supported by the lever body (82) and is capable of coming into contact with the first rotating body (50).

7. The train wheel setting mechanism according to any one of claims 3 to 5, further comprising:

   an interlocking portion (22) that displaces in conjunction with displacement in an axial direction

of the winding stem (13), wherein
the train wheel setting lever (71) includes:

a lever body (282) that is supported by the bridge member (12);
an engaging portion (283) that is supported by the lever body and is capable of engaging with the interlocking portion (22); and
a contacting portion (284) that is supported by the lever body and is capable of coming into contact with the first rotating body (50).

8. The train wheel setting mechanism according to any one of claims 1 to 7, wherein
the train wheel setting lever includes an elastically deformable portion (173, 284) formed to be flexibly deformable.

9. The train wheel setting mechanism according to claim 6, wherein
the train wheel setting lever (171) includes an elastically deformable portion (173) formed to be flexibly deformable, and
the abutting portion (183) abuts against the winding stem (13) in a state in which the contacting portion (184) is in contact with the first rotating body (50).

10. The train wheel setting mechanism according to any one of claims 1 to 9, wherein
the train wheel setting lever (71) is disposed on an opposite side to the main plate (12) with the bridge member interposed therebetween.

11. The train wheel setting mechanism according to any one of claims 1 to 9, wherein
the train wheel setting lever (471) is disposed between the bridge member (412) and the main plate (10).

12. A timepiece movement (4) comprising:
the train wheel setting mechanism according to any one of claims 1 to 11.

13. A timepiece (1) comprising:
the timepiece movement according to claim 12.

FIG. 1

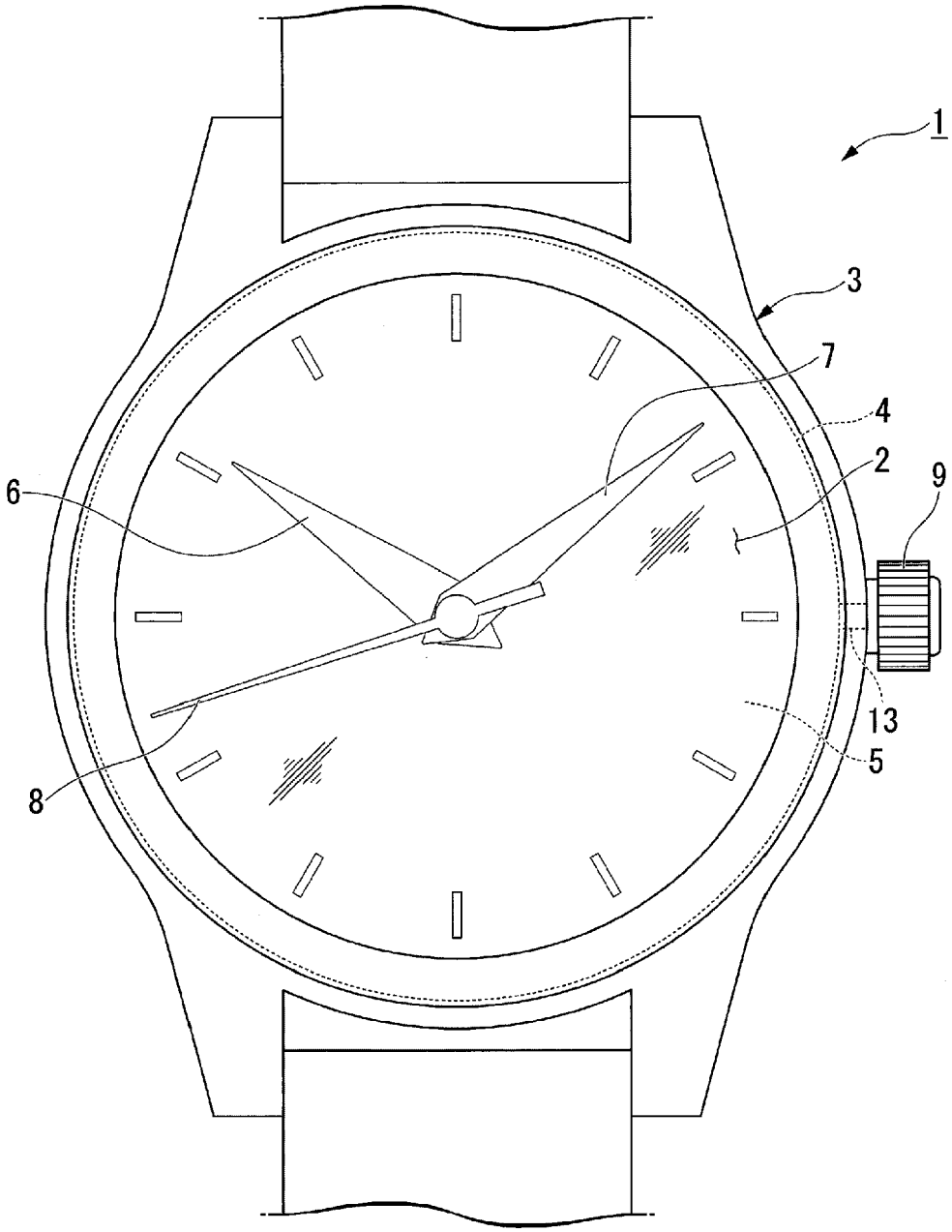


FIG. 2

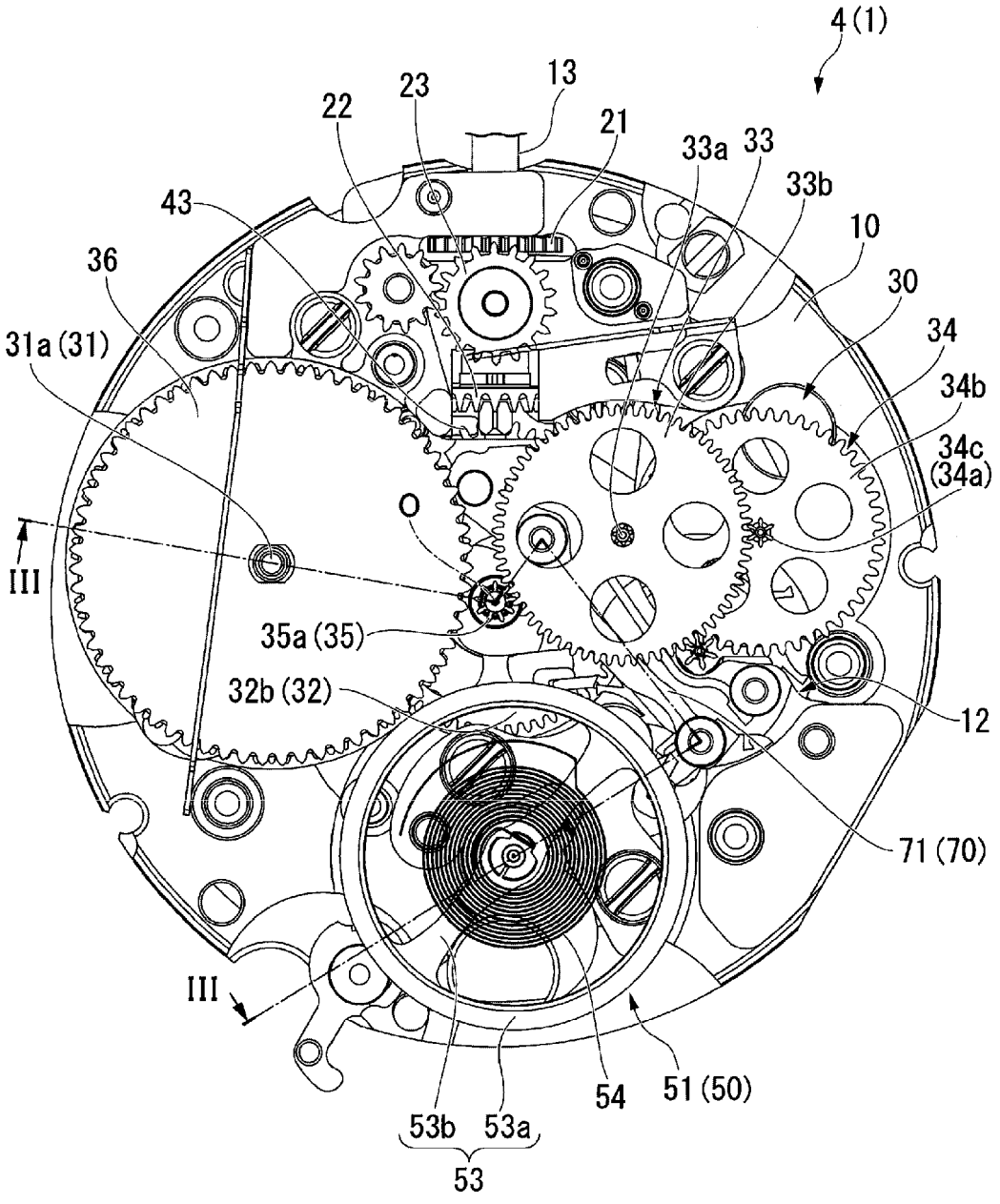

4 (1)
13
23
22
21
33a
33
33b
10
43
36
30
34
31a (31)
34b
34c
(34a)
O
III
35a (35)
32b (32)
12
71 (70)
III
54
51 (50)
53b
53a
53

FIG. 3

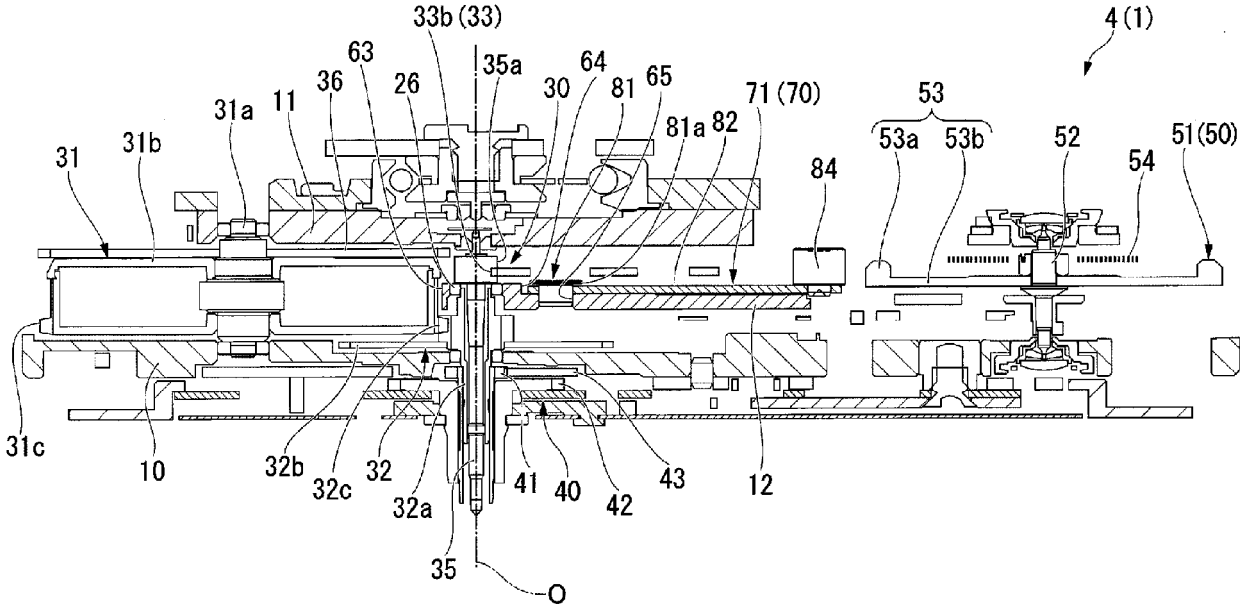

33b (33)
4 (1)
63
35a
64
36
26
30
81
65
71 (70)
53
31a
11
81a
82
53a
53b
52
51 (50)
31
31b
84
54
31c
10
32b
32c
32
32a
41
40
42
43
12
35
O

FIG. 4

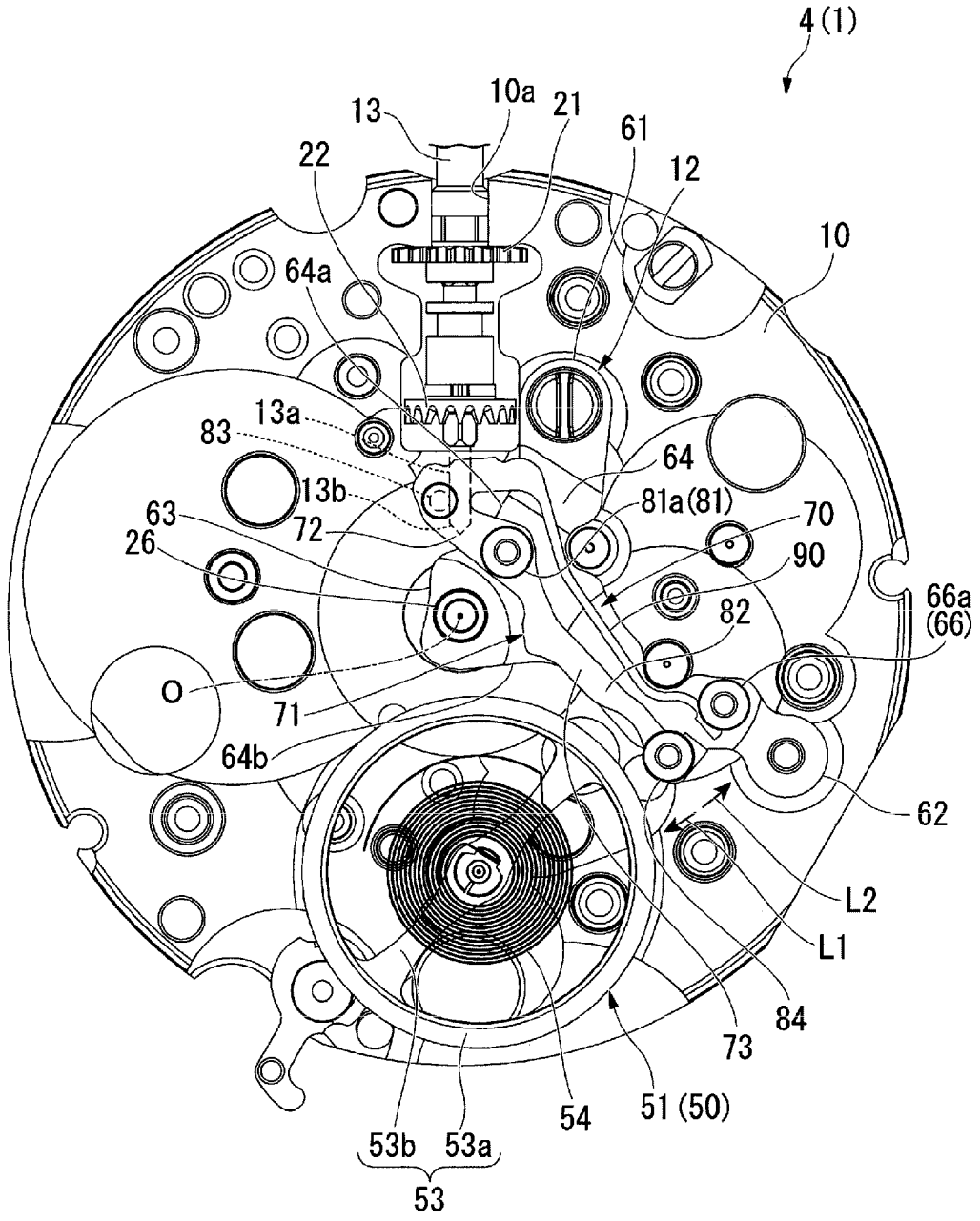

4 (1)
13
10a
21
61
22
12
10
64a
13a
83
64
13b
81a(81)
70
63
72
90
26
66a
(66)
82
O
71
64b
62
L2
L1
84
73
54
51 (50)
53b
53a
53

FIG. 5

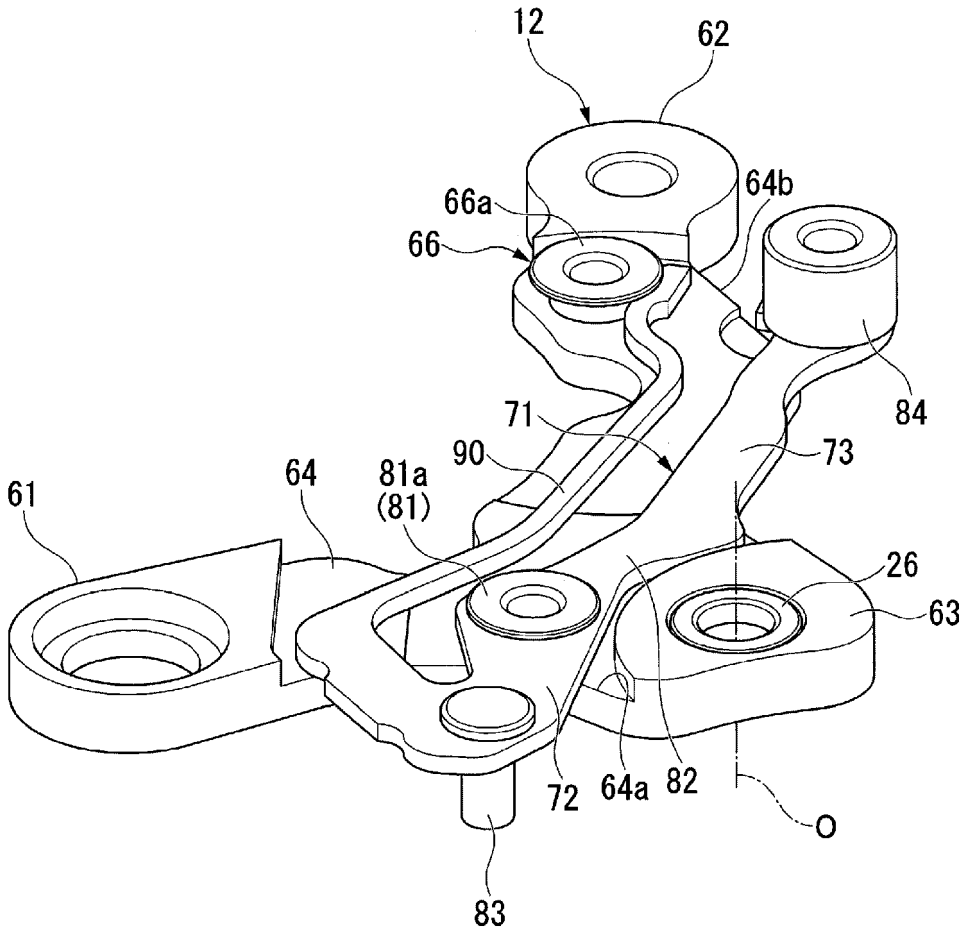


FIG. 6

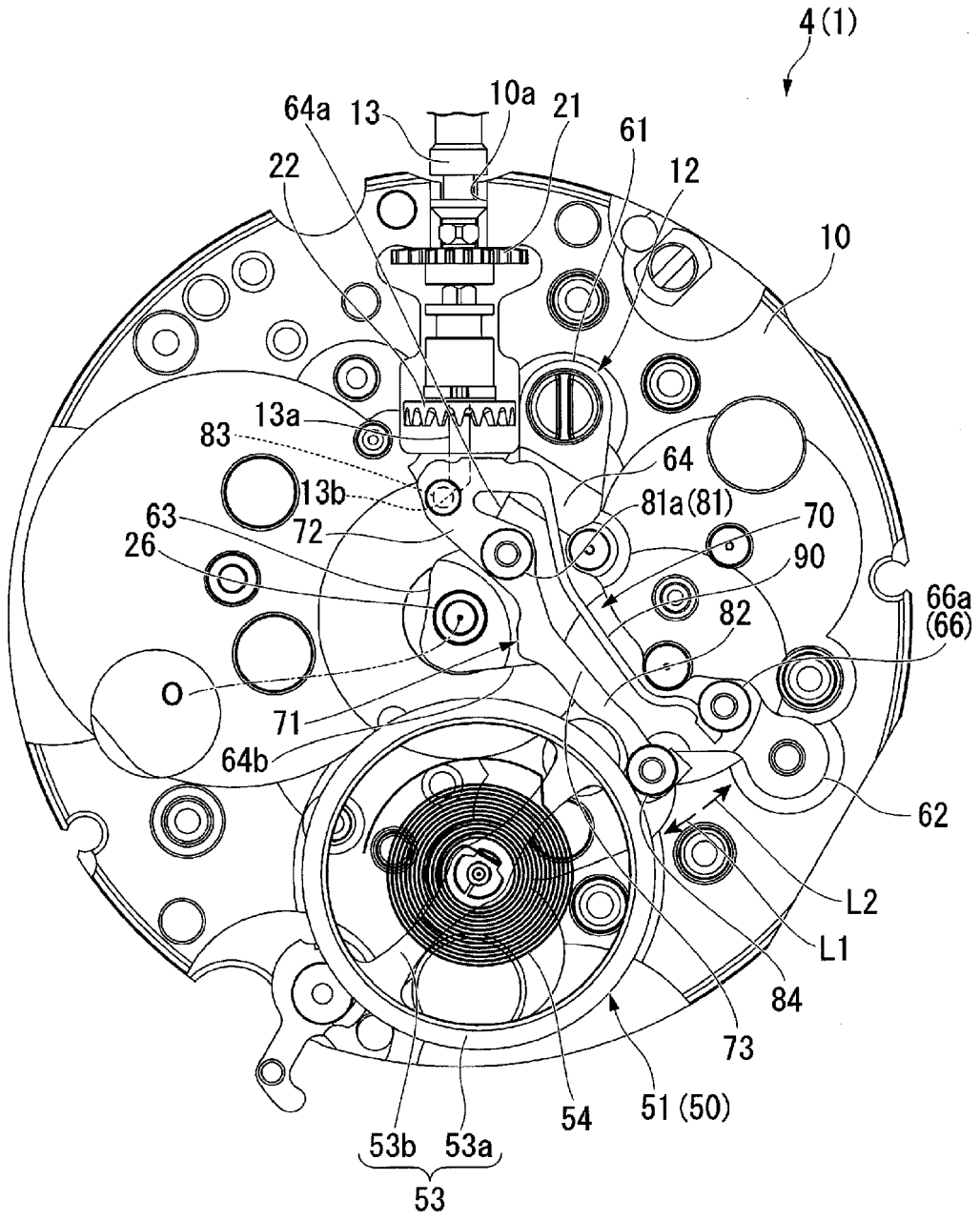

4(1)
64a
13
10a
21
61
22
12
10
13a
83
64
13b
81a(81)
70
63
72
90
26
66a
(66)
82
O
71
64b
62
L2
L1
84
73
54
51(50)
53b
53a
53

FIG. 7

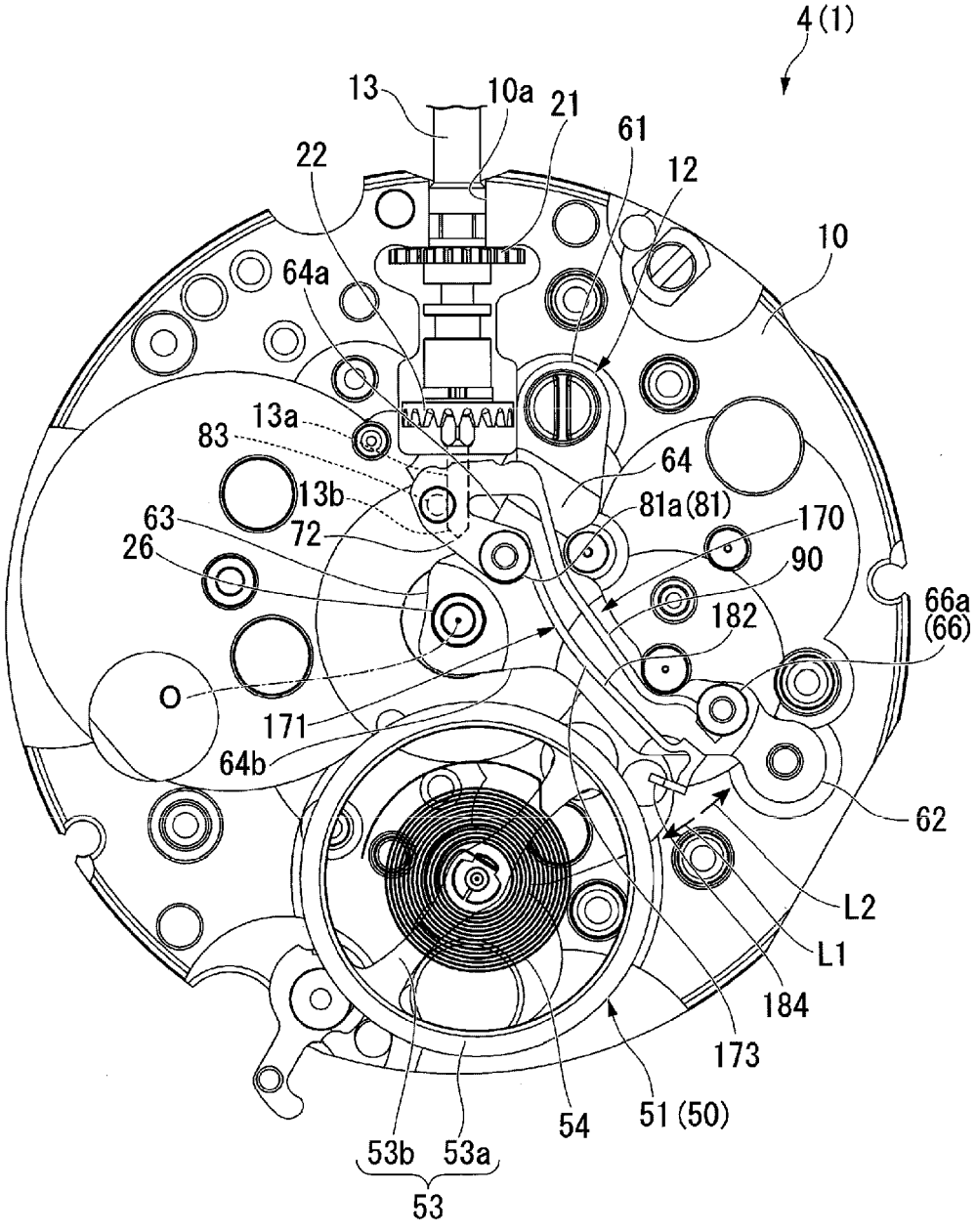

4(1)
13
10a
21
61
22
12
10
64a
13a
83
64
13b
81a(81)
170
63
72
26
90
66a
(66)
182
O
171
64b
62
L2
L1
184
173
54
51(50)
53b
53a
53

FIG. 8

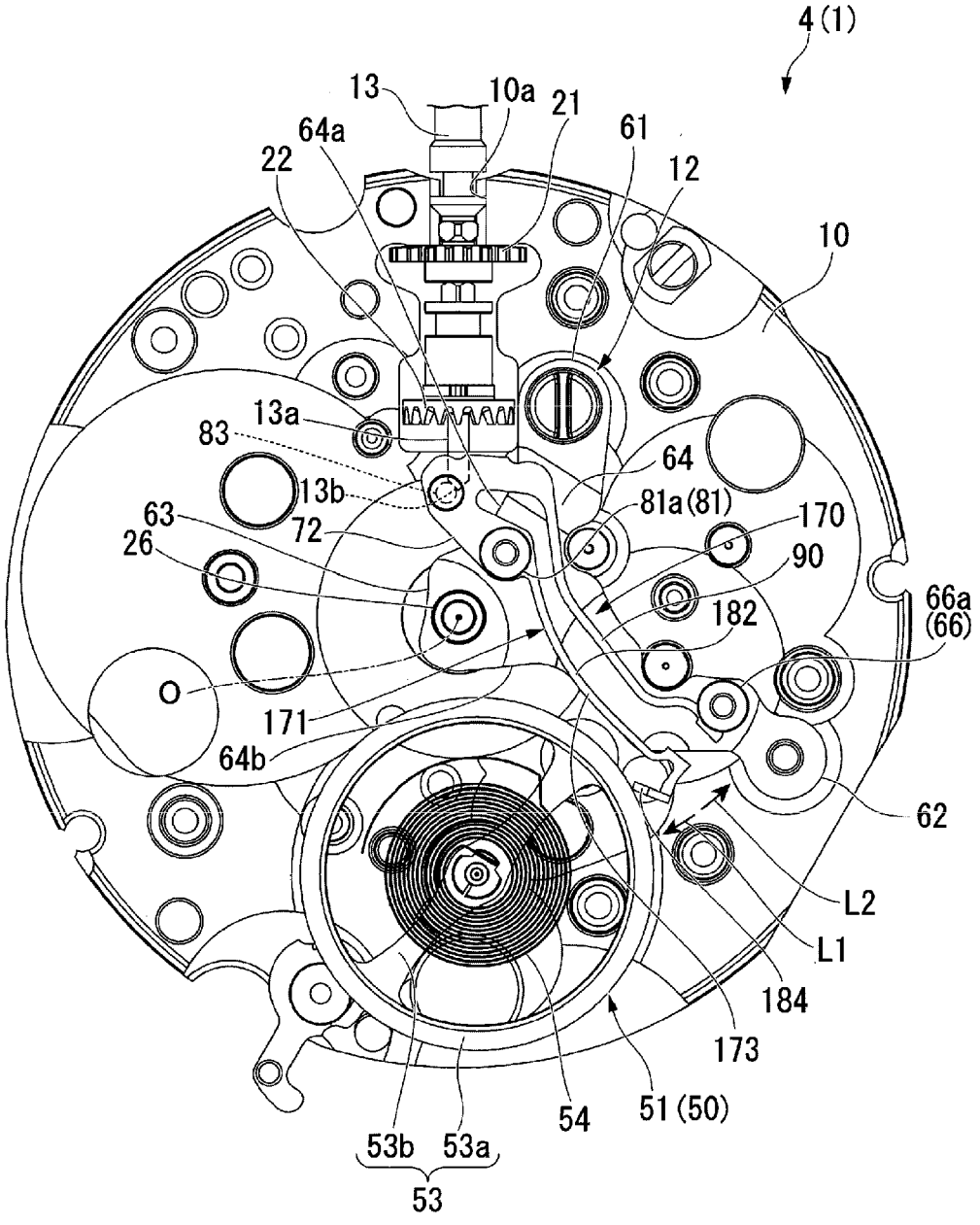

4(1)
13
10a
21
61
64a
22
12
10
13a
83
64
13b
81a(81)
170
63
72
26
90
66a
(66)
182
O
171
64b
62
L2
L1
184
173
54
51(50)
53b
53a
53

FIG. 9

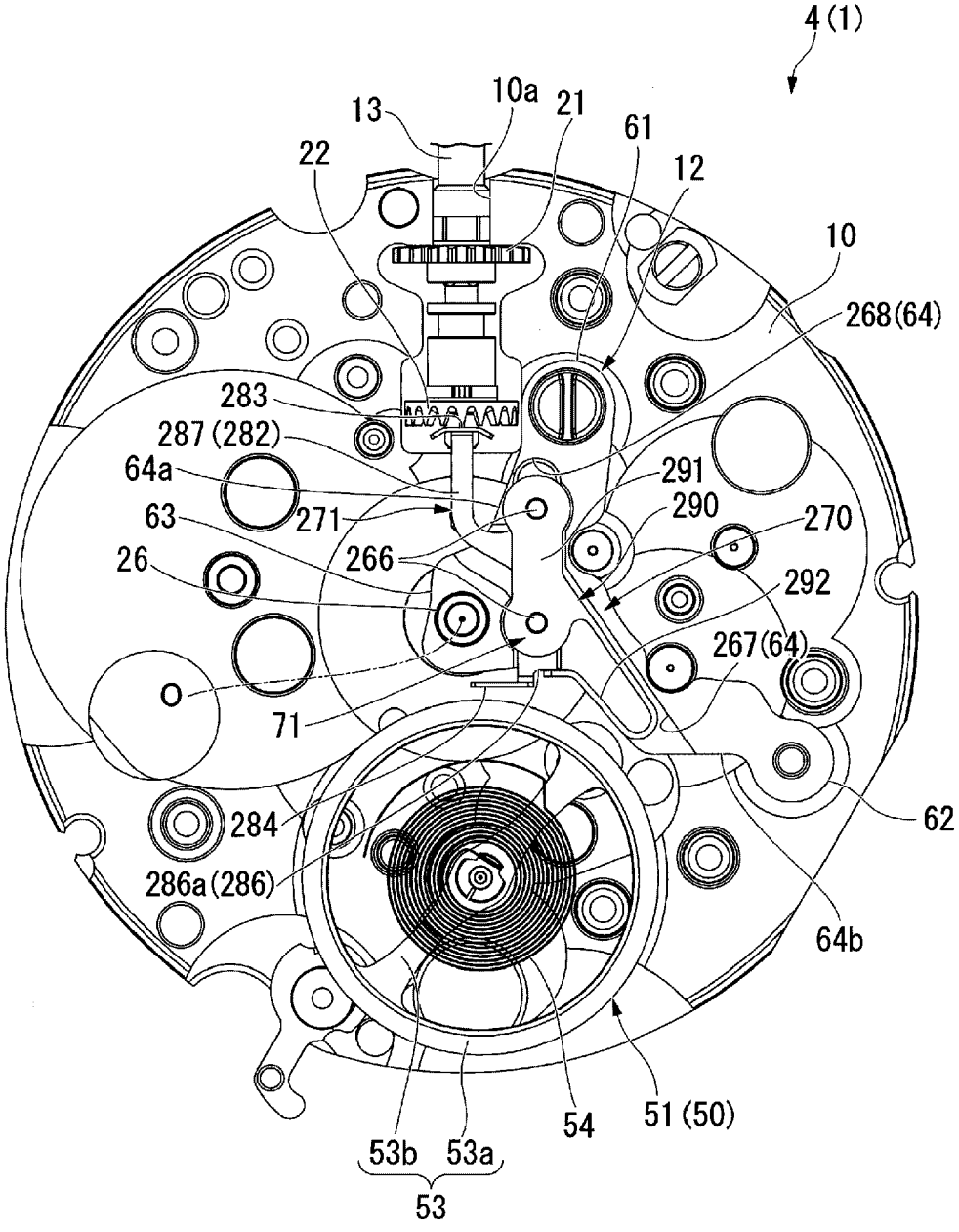

4(1)
13
10a
21
61
22
12
10
268(64)
283
287(282)
64a
291
63
271
290
270
26
266
292
267(64)
O
71
284
62
286a(286)
64b
54
51(50)
53b
53a
53

FIG. 10

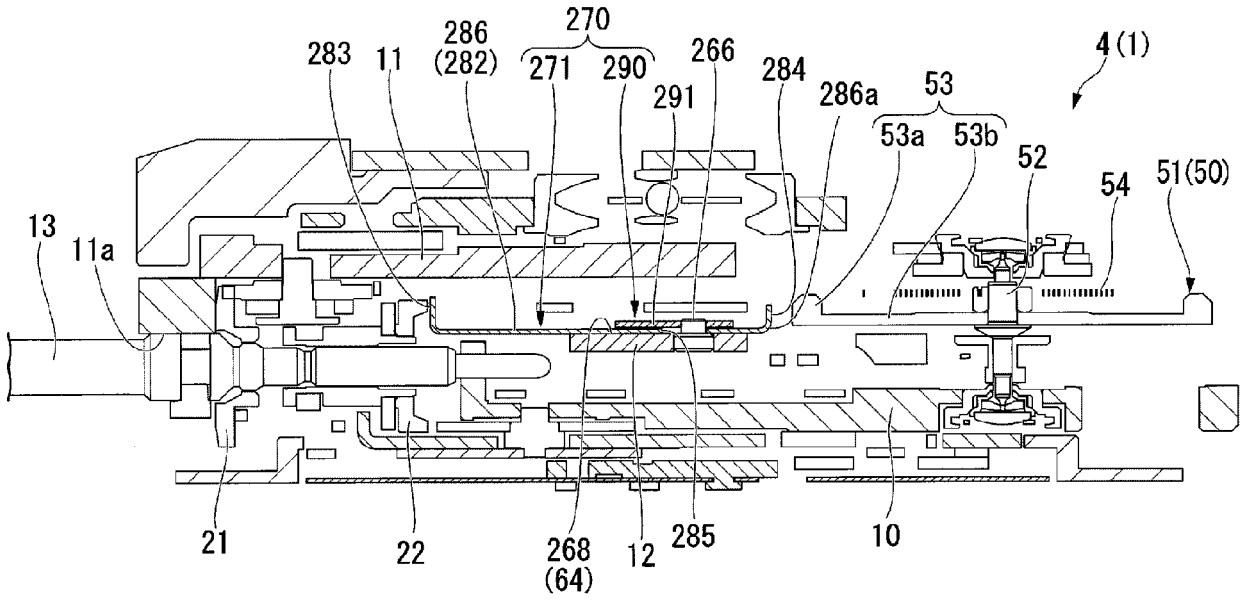

283
11
286
(282)
270
271
290
291
266
284
286a
53
53a
53b
52
54
51(50)
4(1)
13
11a
21
22
268
(64)
12
285
10

FIG. 11

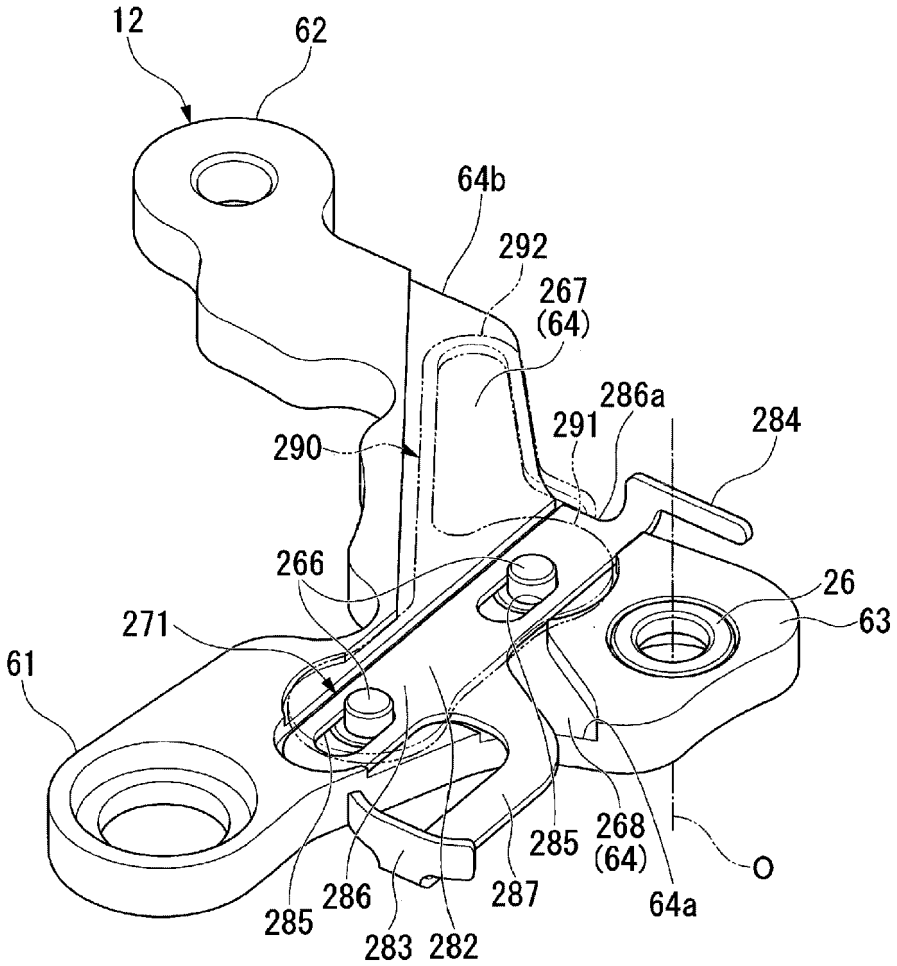

12
62
64b
292
267
(64)
286a
291
284
290
266
26
271
63
61
285
268
(64)
O
286
287
64a
285
283
282

FIG. 12

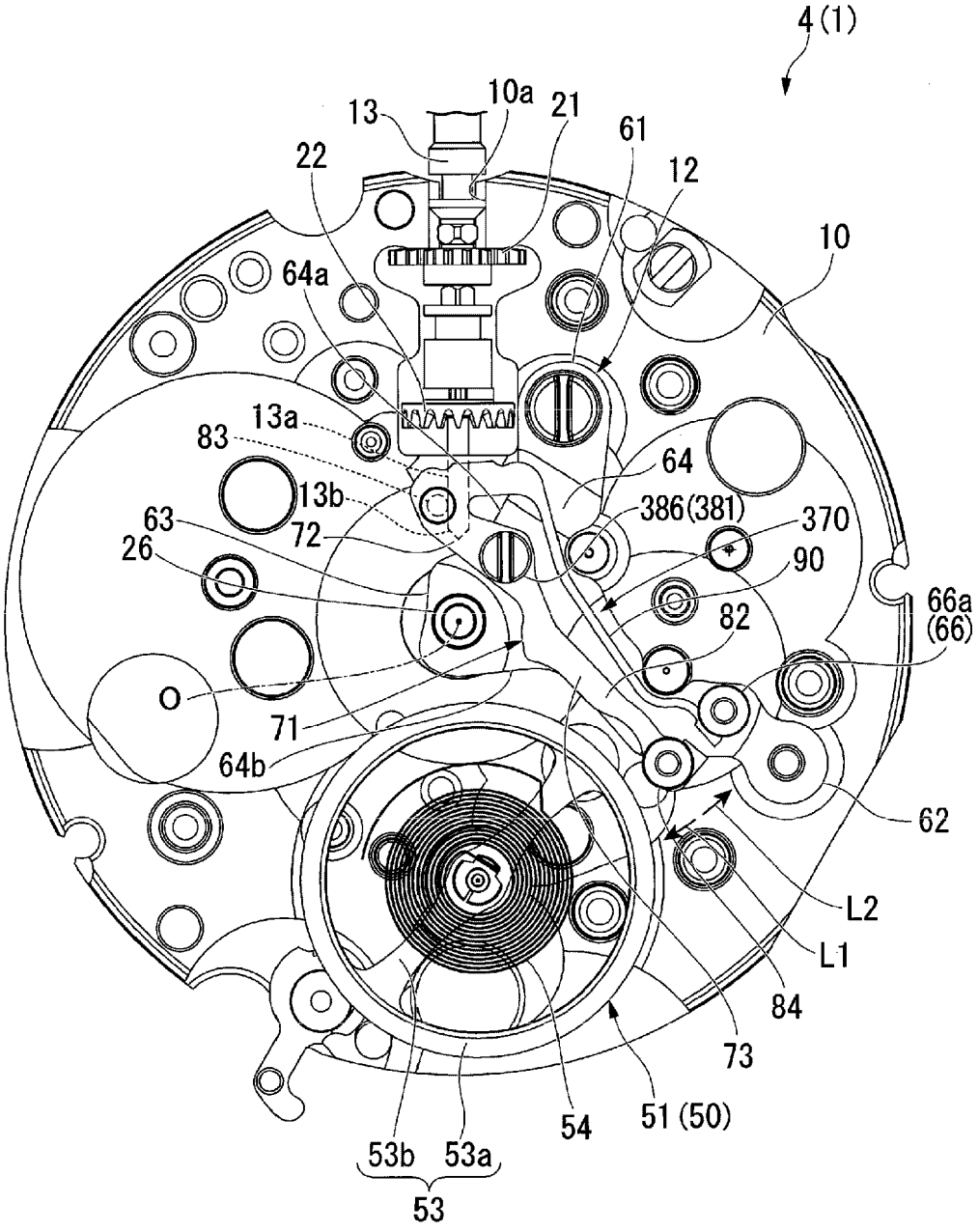

4(1)
13
10a
21
61
22
12
10
64a
13a
83
64
13b
386(381)
370
63
72
26
90
66a
(66)
82
O
71
64b
62
L2
L1
84
73
54
51(50)
53b
53a
53

FIG. 13

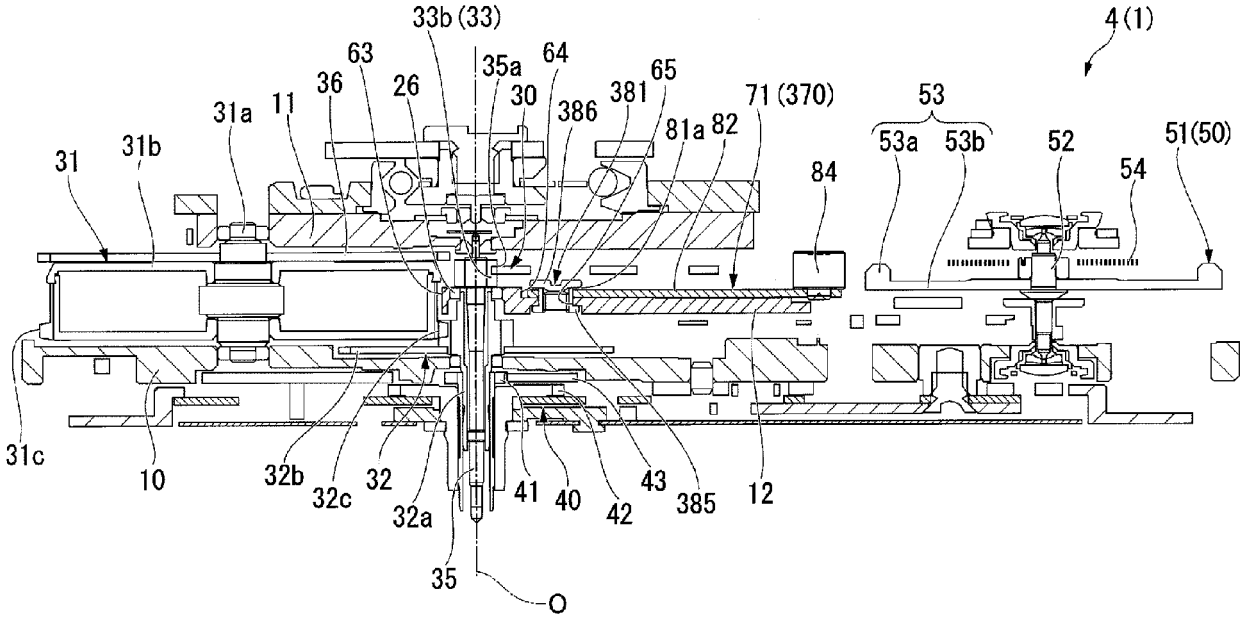

33b (33)
4 (1)
63
35a
64
36
26
30
65
381
71 (370)
53
31a
11
386
81a
82
53a
53b
52
51(50)
31
31b
84
54
31c
10
32b
32c
32
32a
41
40
42
43
385
12
35
O

FIG. 14

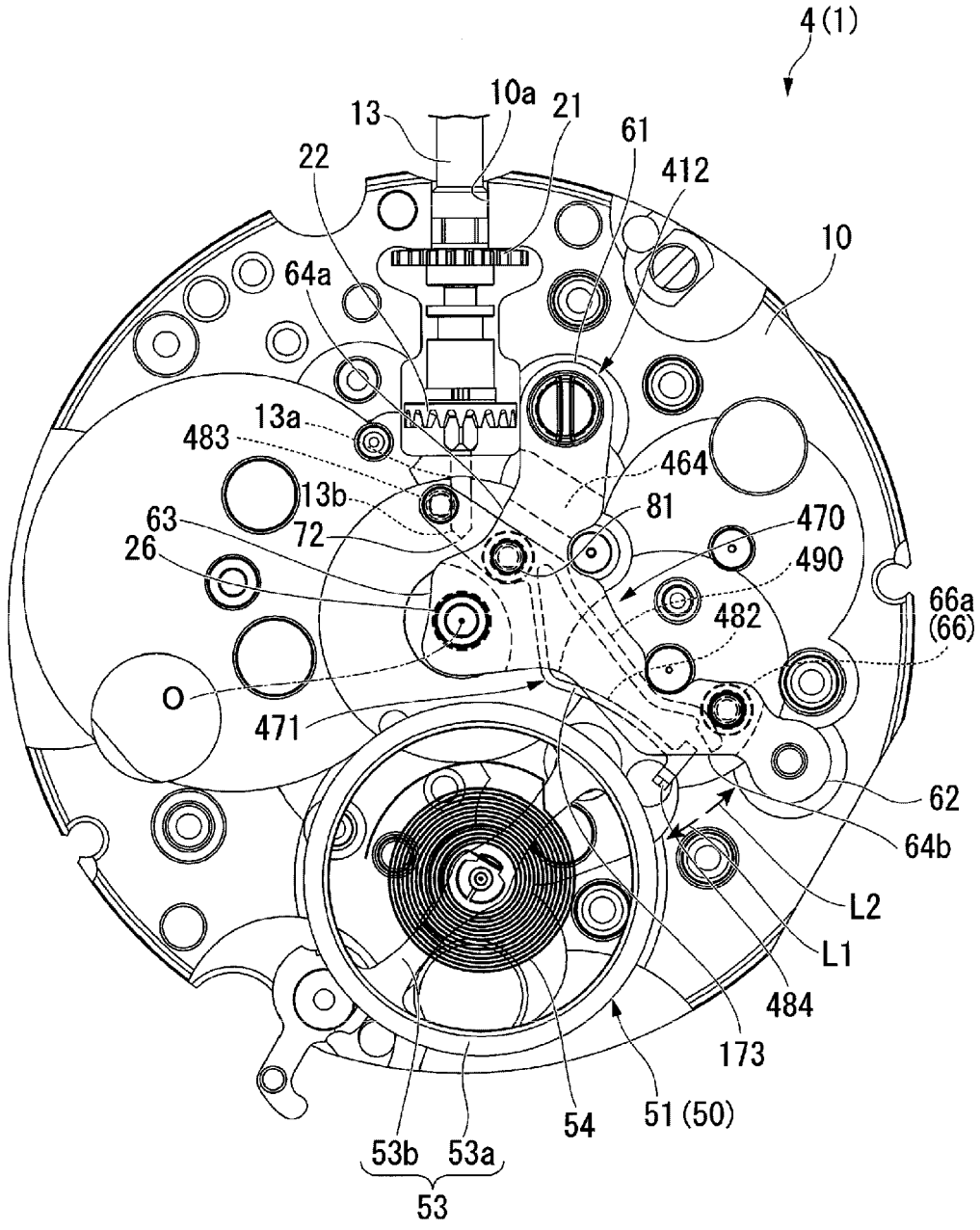
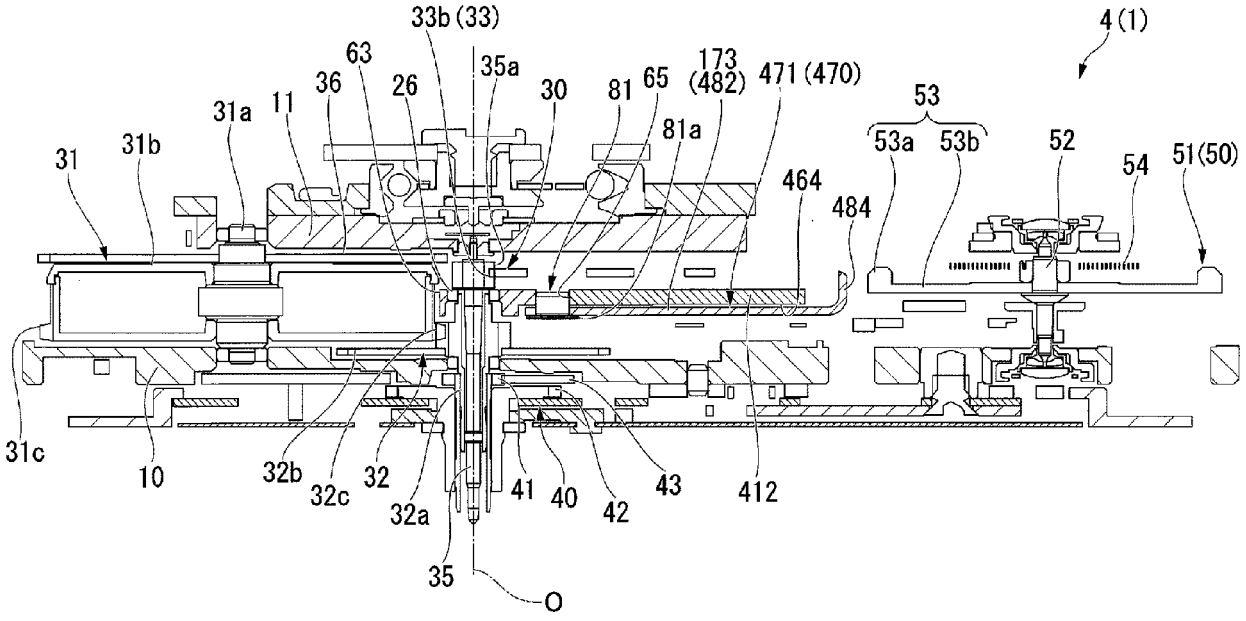

4 (1)
13
10a
21
61
22
412
10
64a
13a
483
464
13b
81
63
72
470
26
490
66a
(66)
482
O
471
62
64b
L2
L1
484
173
54
51 (50)
53b
53a
53

FIG. 15


33b (33)
4 (1)
63
35a
173
(482)
471 (470)
36
26
30
81
65
53
31a
11
81a
53a
53b
52
54
51(50)
31
31b
464
484
31c
10
32b
32c
32
32a
41
40
42
43
412
35
O

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 19 5523

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	CH 706 108 A2 (SOPROD SA [CH]) 30 August 2013 (2013-08-30) * paragraphs [0006], [0009]; figures 1-3 * -----	1,2,8, 11-13 3-7,9,10	INV. G04B27/00
X A	FR 2 168 453 A1 (TIMEX CORP [US]) 31 August 1973 (1973-08-31) * figures 1,2 * -----	1,2,8, 10,12,13 3-7,9,11	
A	JP 2017 161511 A (SEIKO INSTR INC) 14 September 2017 (2017-09-14) * paragraph [0004]; figures 5,6 * -----	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

G04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 January 2021	Scordel, Maxime

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 20 19 5523

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.

22-01-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH 706108 A2	30-08-2013	NONE	
FR 2168453 A1	31-08-1973	AU 464585 B2	28-08-1975
		BE 794271 A	16-05-1973
		CA 959659 A	24-12-1974
		CH 569315 B5	14-11-1975
		CH 1851272 A4	30-05-1975
		DE 2202846 A1	26-07-1973
		FR 2168453 A1	31-08-1973
		GB 1391233 A	16-04-1975
		IT 976926 B	10-09-1974
		JP S4883864 A	08-11-1973
		NL 7300686 A	24-07-1973
		US 3765164 A	16-10-1973
JP 2017161511 A	14-09-2017	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 2006234677 A **[0002]**