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Shirai

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- (54) **BICYCLE OPERATING DEVICE**
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CPC **B62K 23/04** (2013.01); **F16C 1/18**
(2013.01); **Y10T 74/2048** (2015.01)

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B62L 3/02; B62J 1/08
See application file for complete search history.

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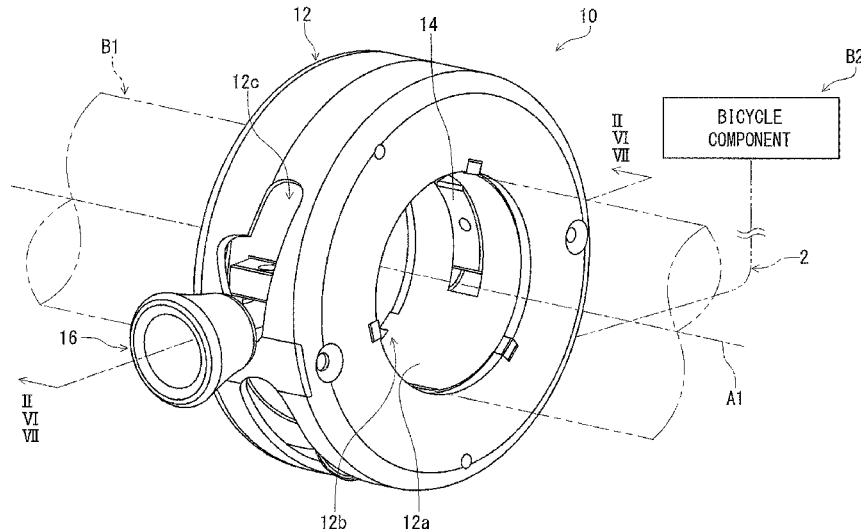
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(57) **ABSTRACT**

A bicycle operating device comprises a base member and an operated member. The operated member is configured to be movable relative to the base member from a rest position to a first operated position along a first path such that an operation cable is pulled relative to the base member by a first amount of movement in a cable operating direction. The operated member is configured to be movable relative to the base member from the rest position to a second operated position along a second path such that the operation cable is pulled relative to the base member by a second amount of movement in the cable operating direction. The second path is at least partially different from the first path. The second amount of movement is different from the first amount of movement.

26 Claims, 15 Drawing Sheets



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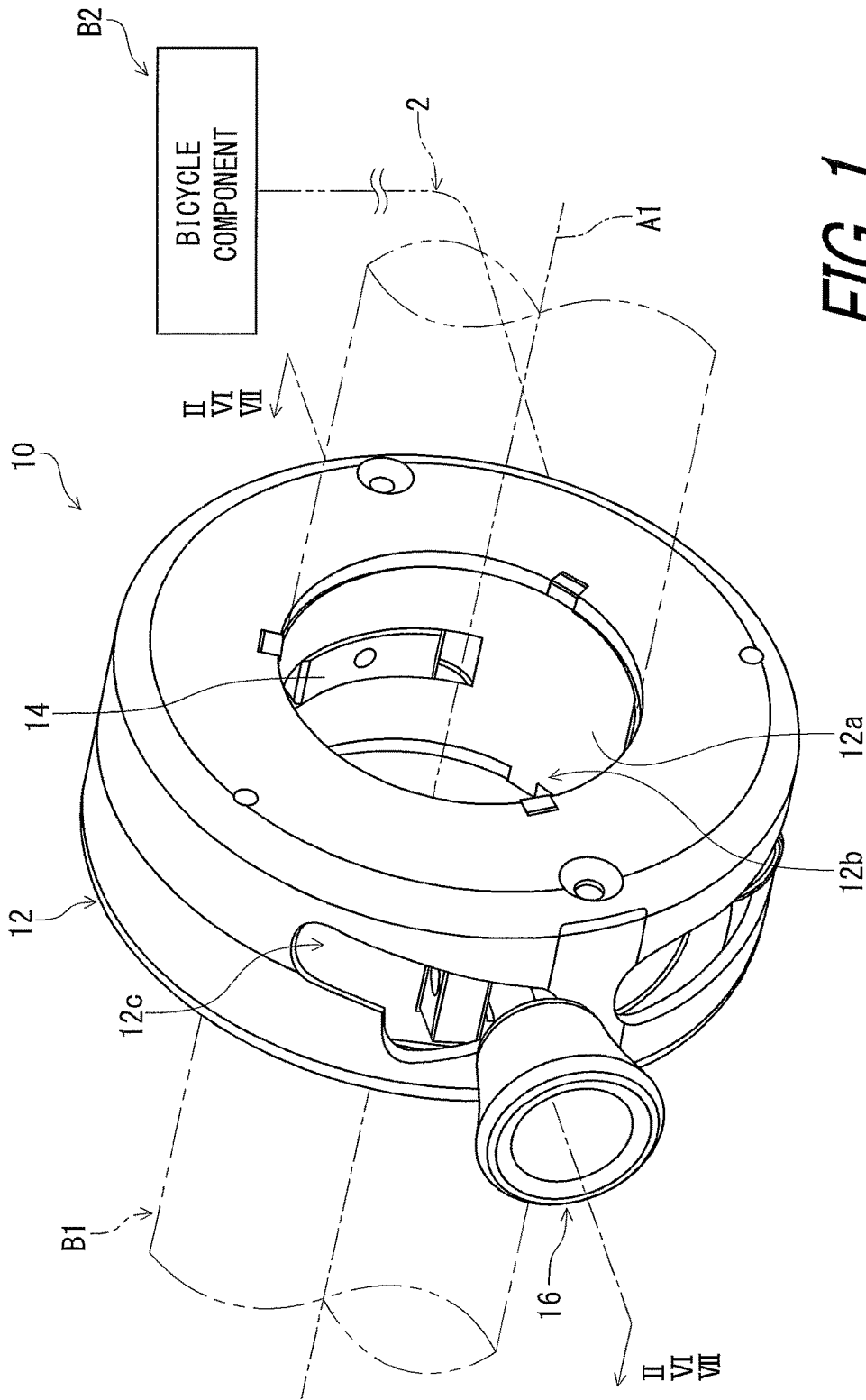
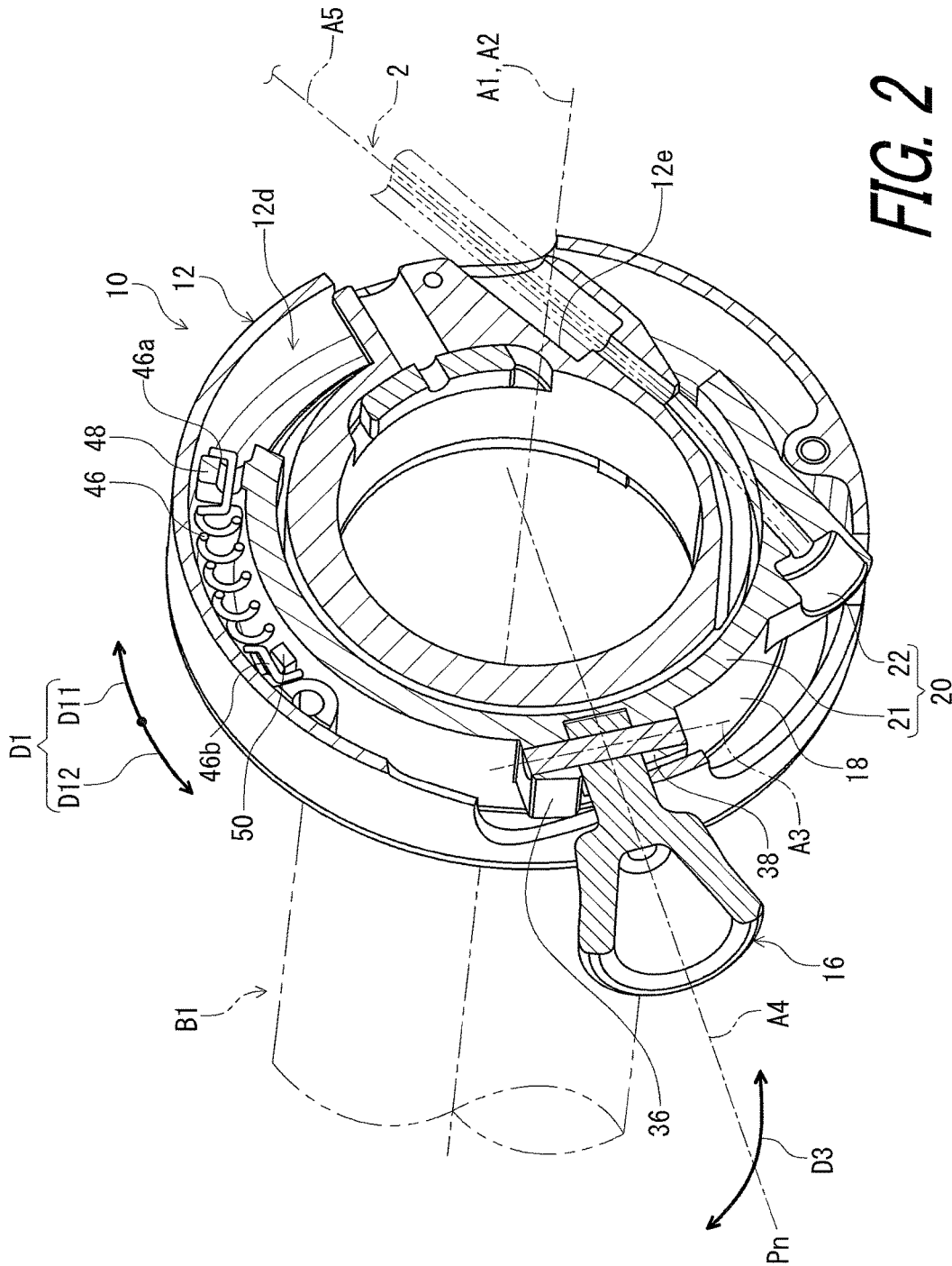


FIG. 1



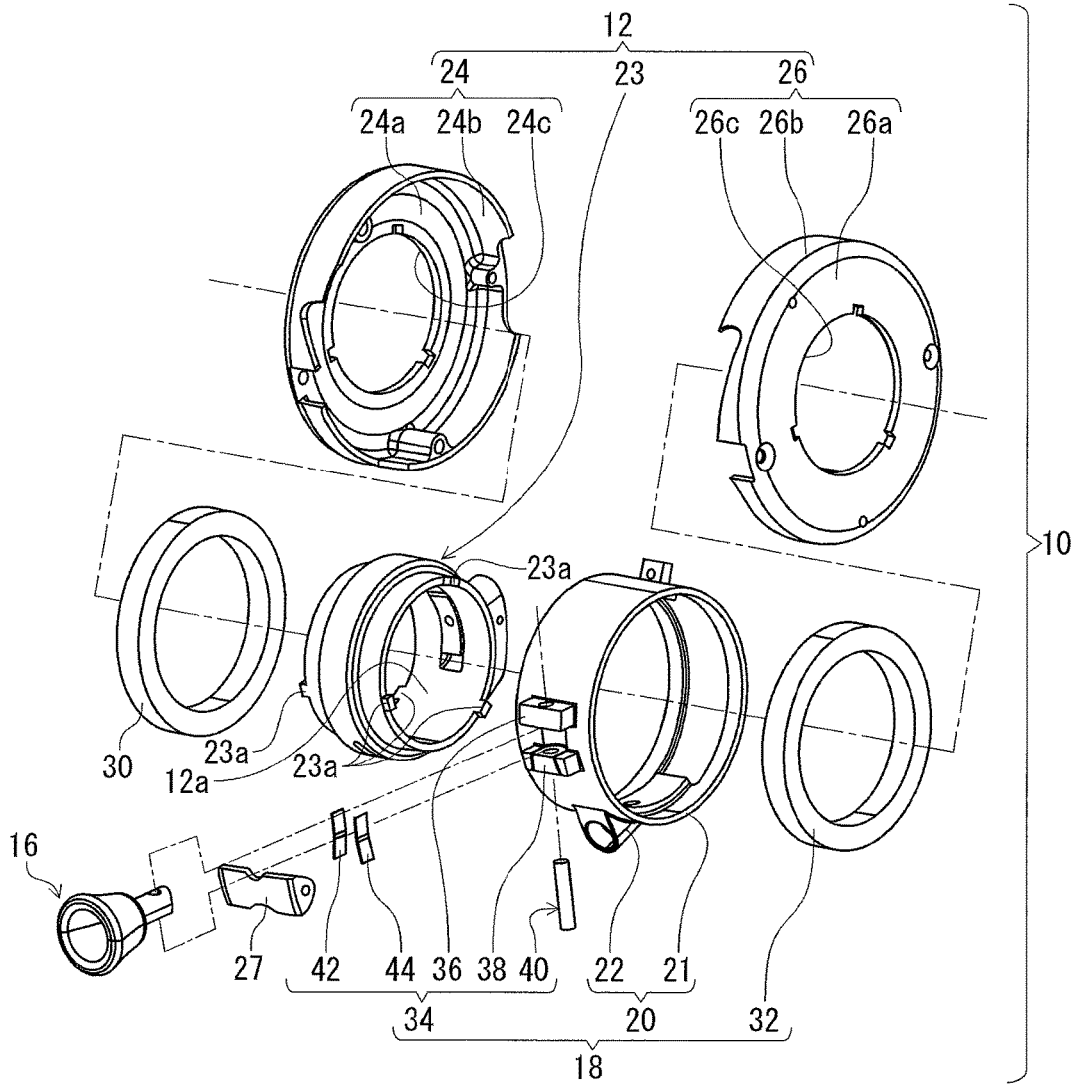


FIG. 3

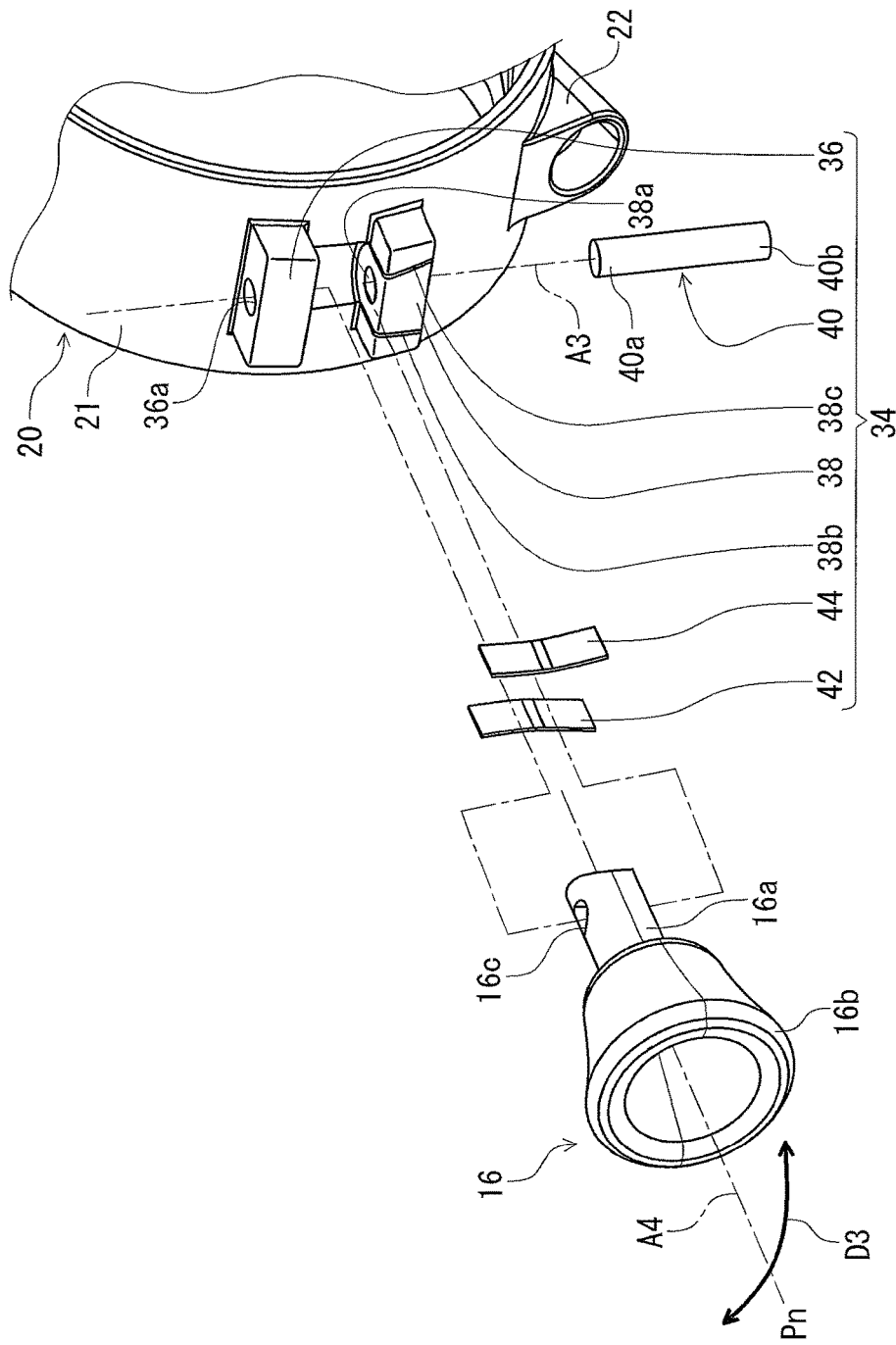


FIG. 4

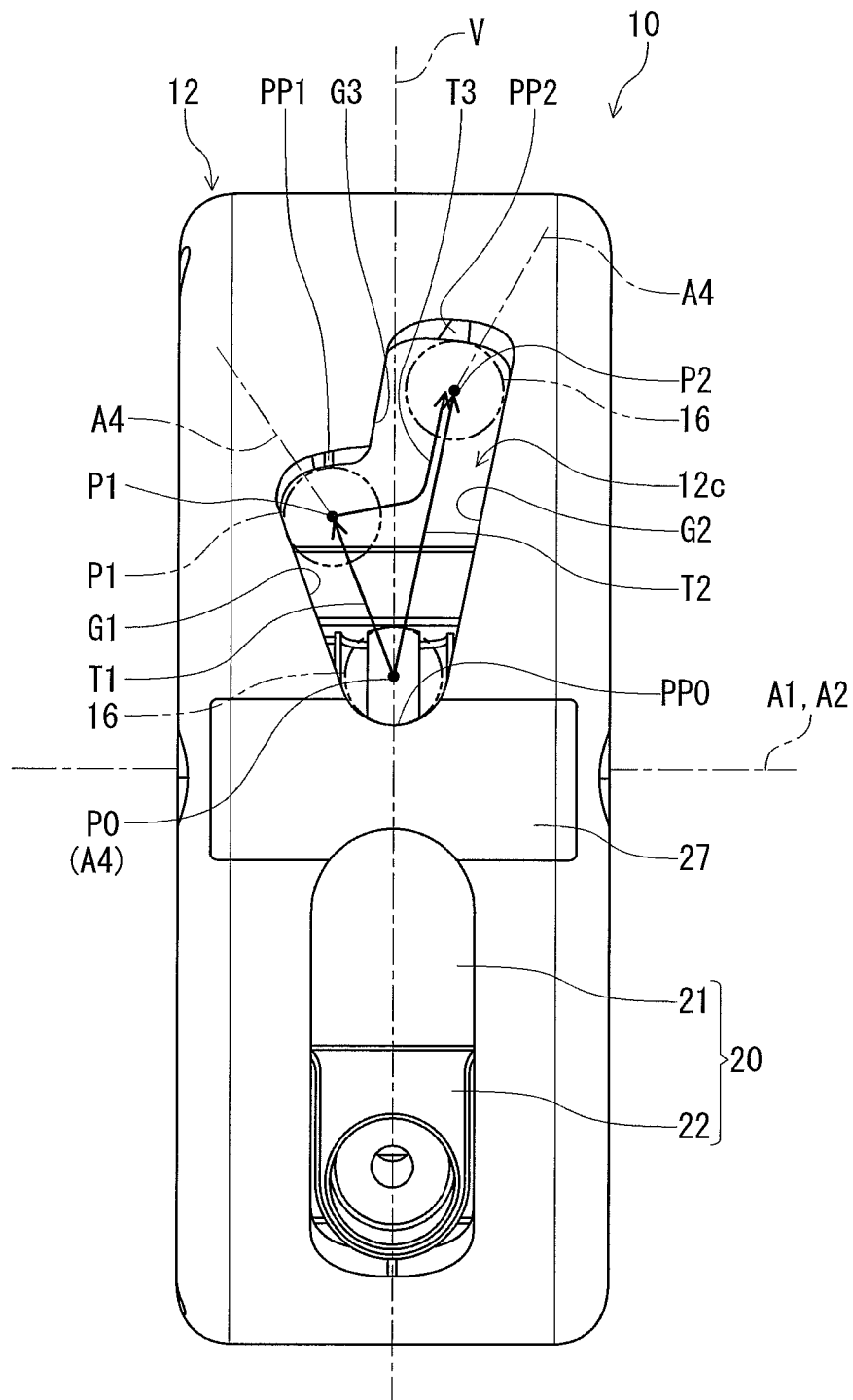


FIG. 5

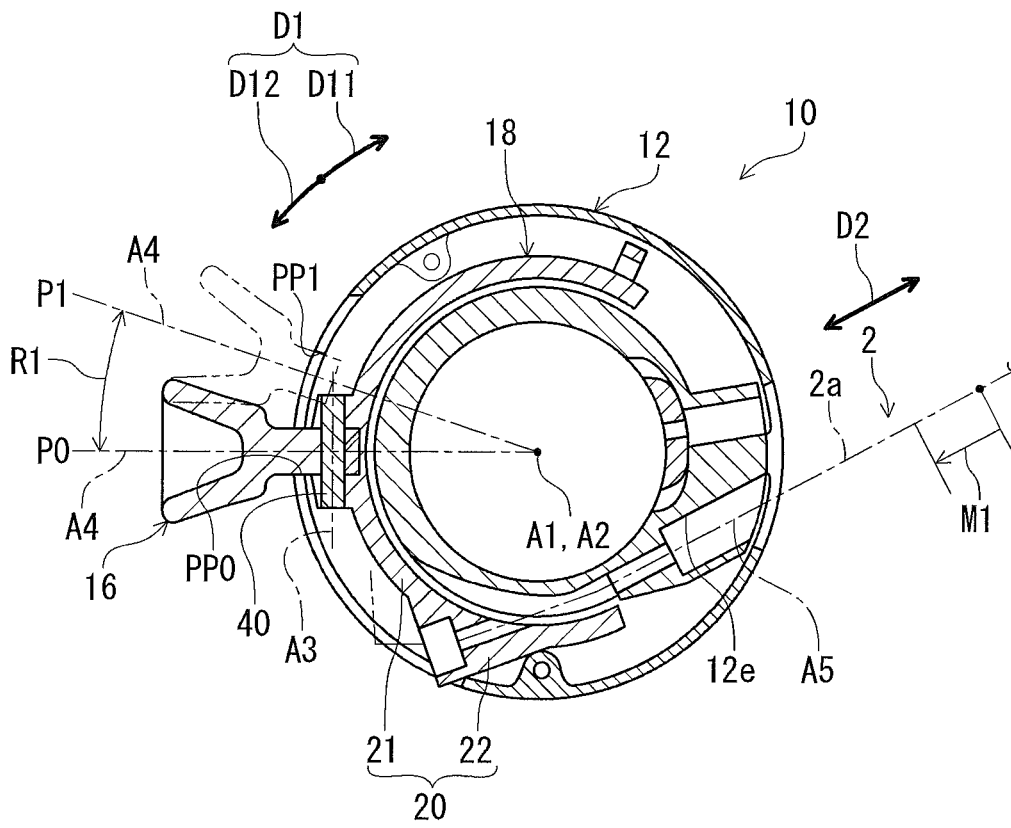


FIG. 6

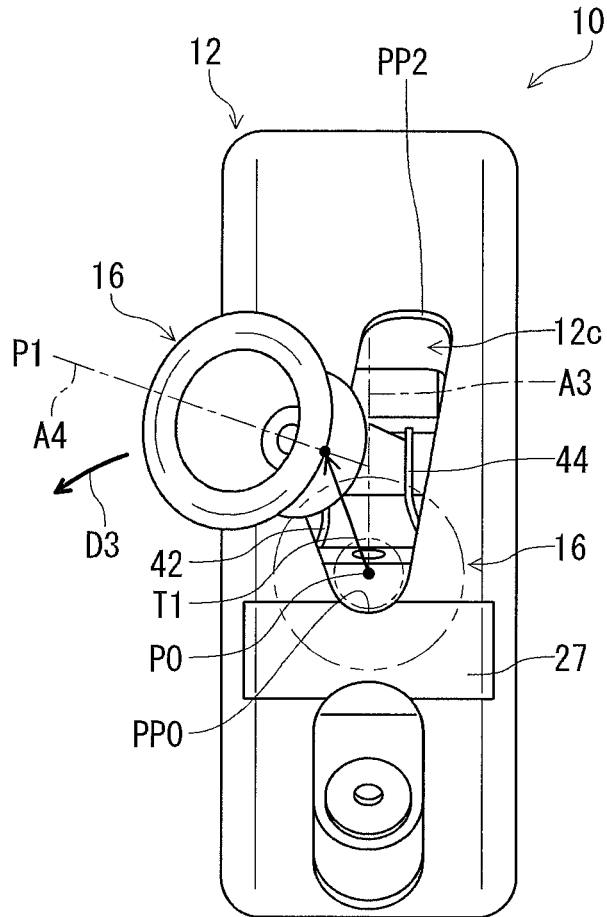


FIG. 8

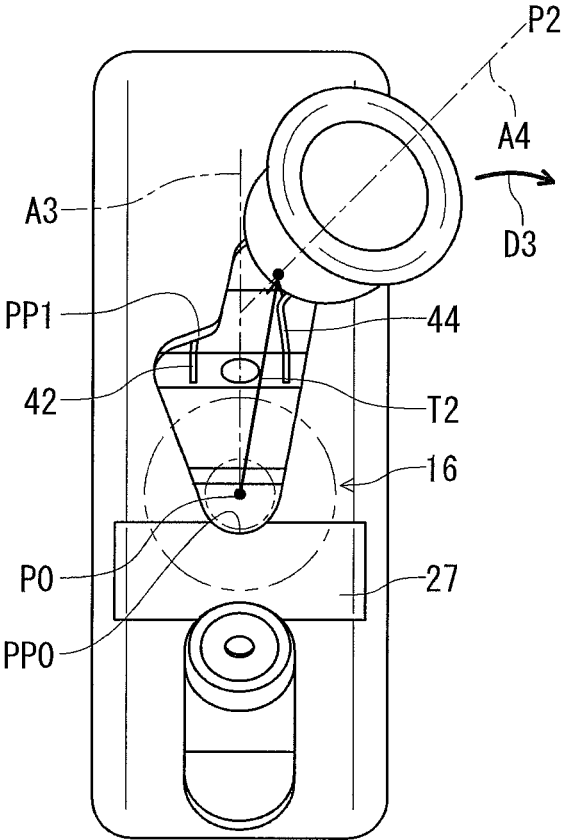


FIG. 9

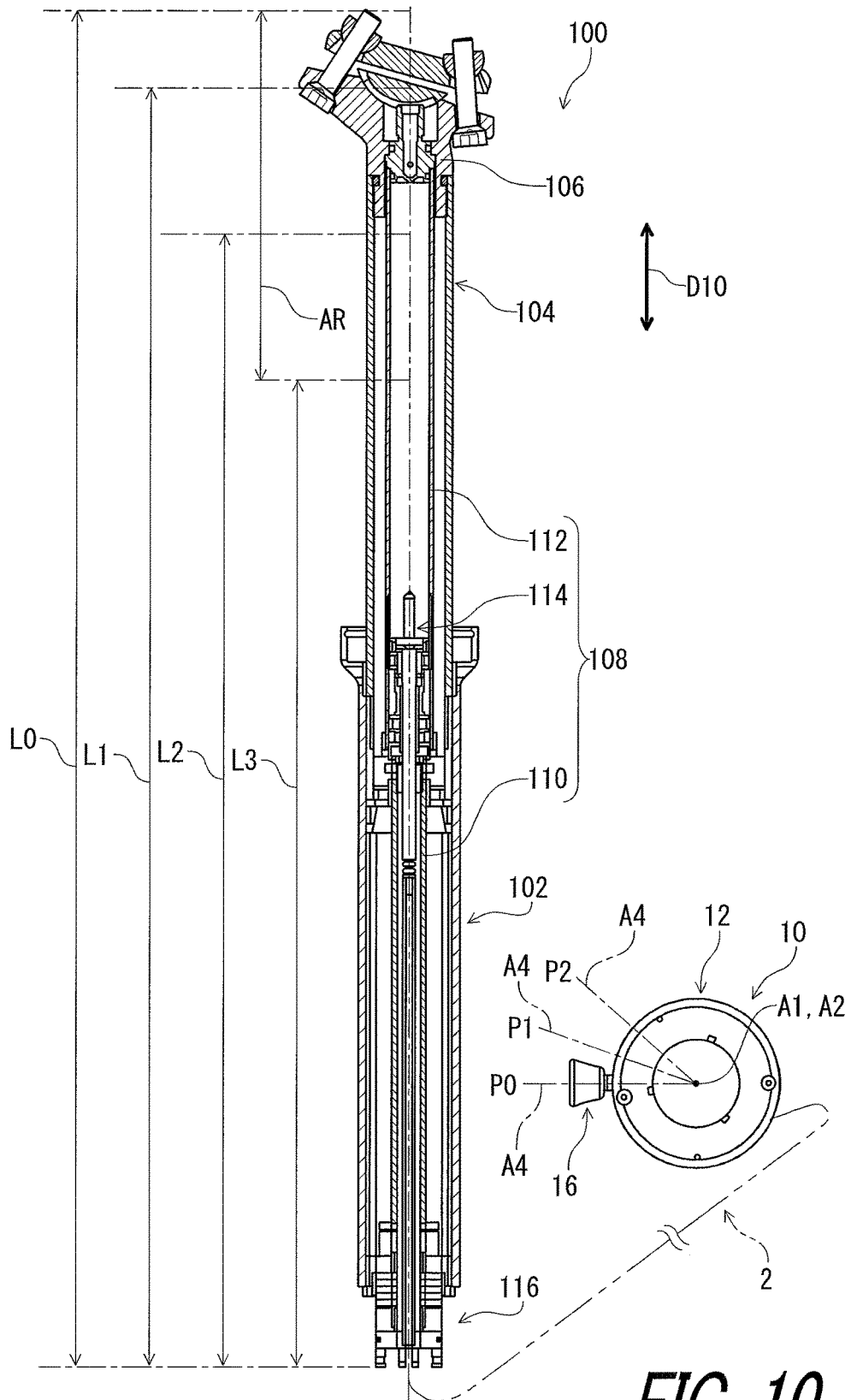


FIG. 10

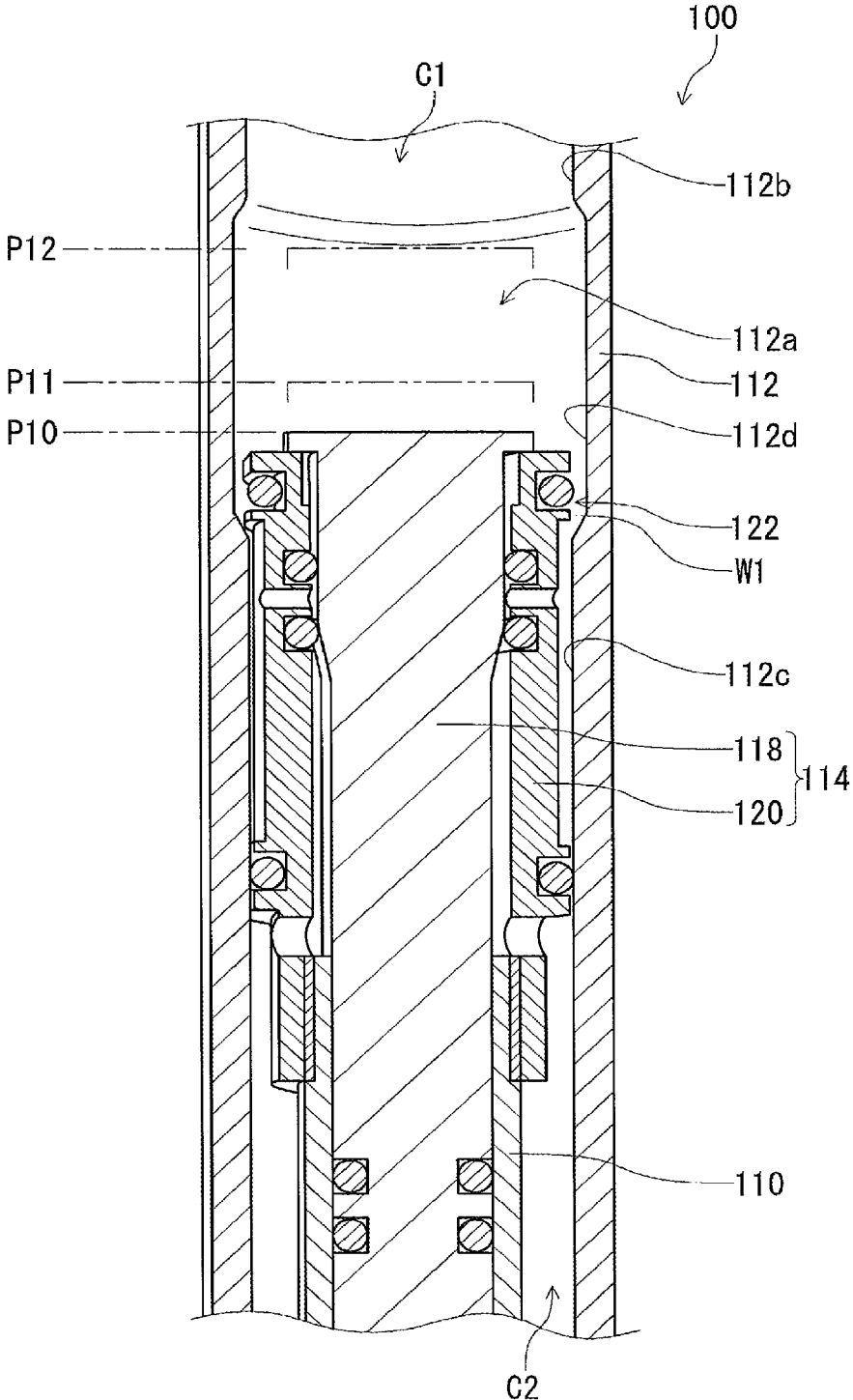


FIG. 11

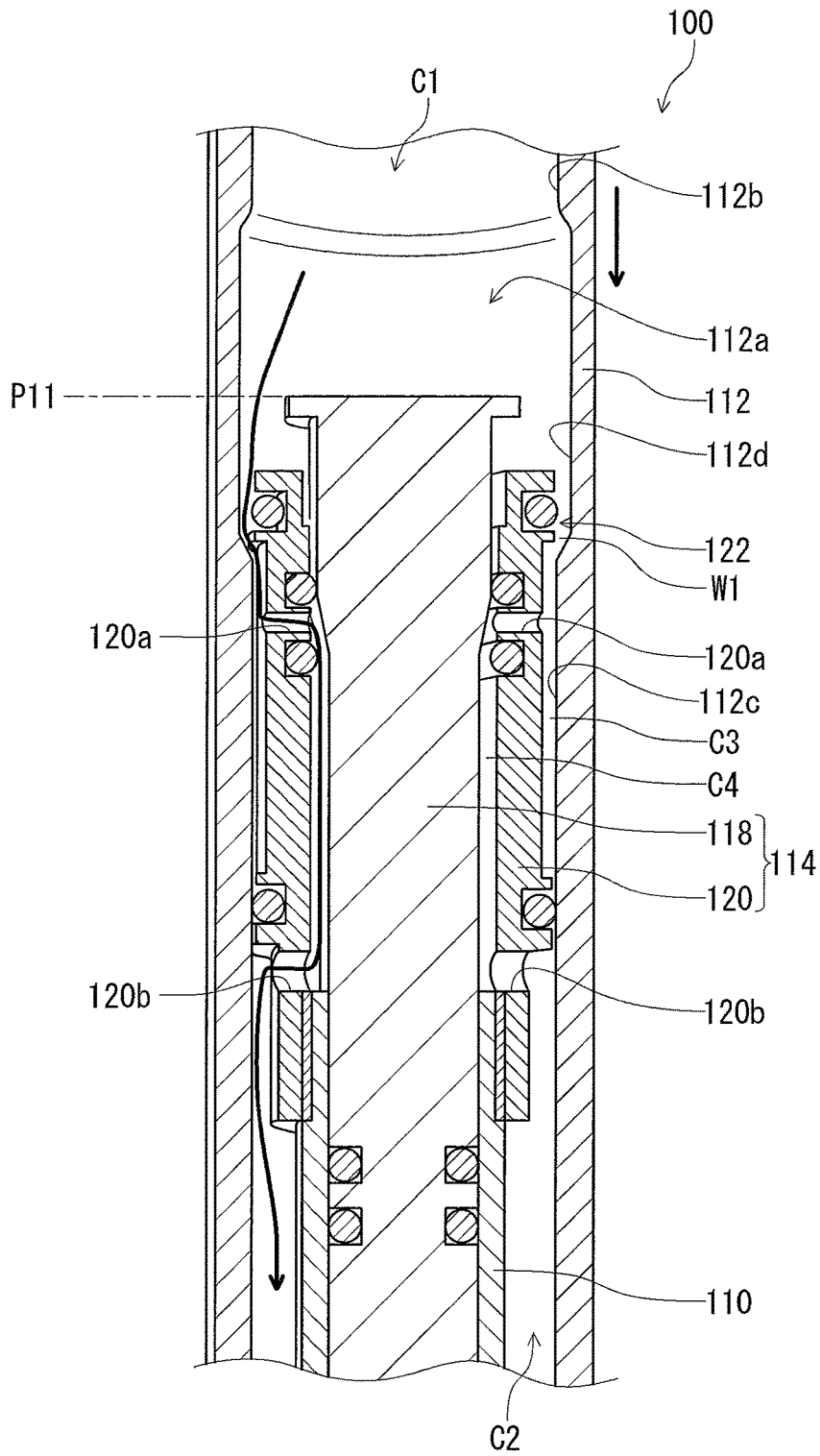


FIG. 12

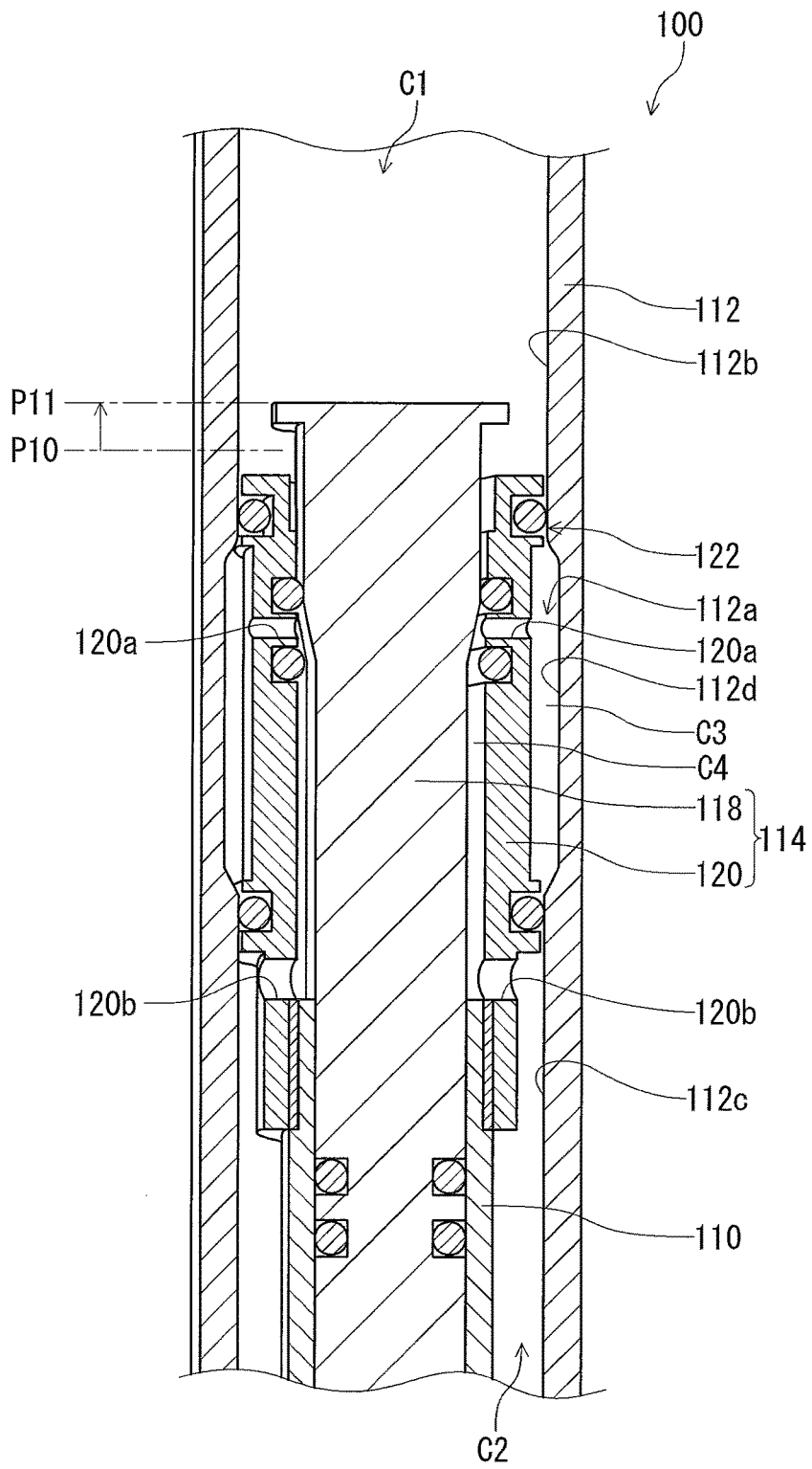


FIG. 13

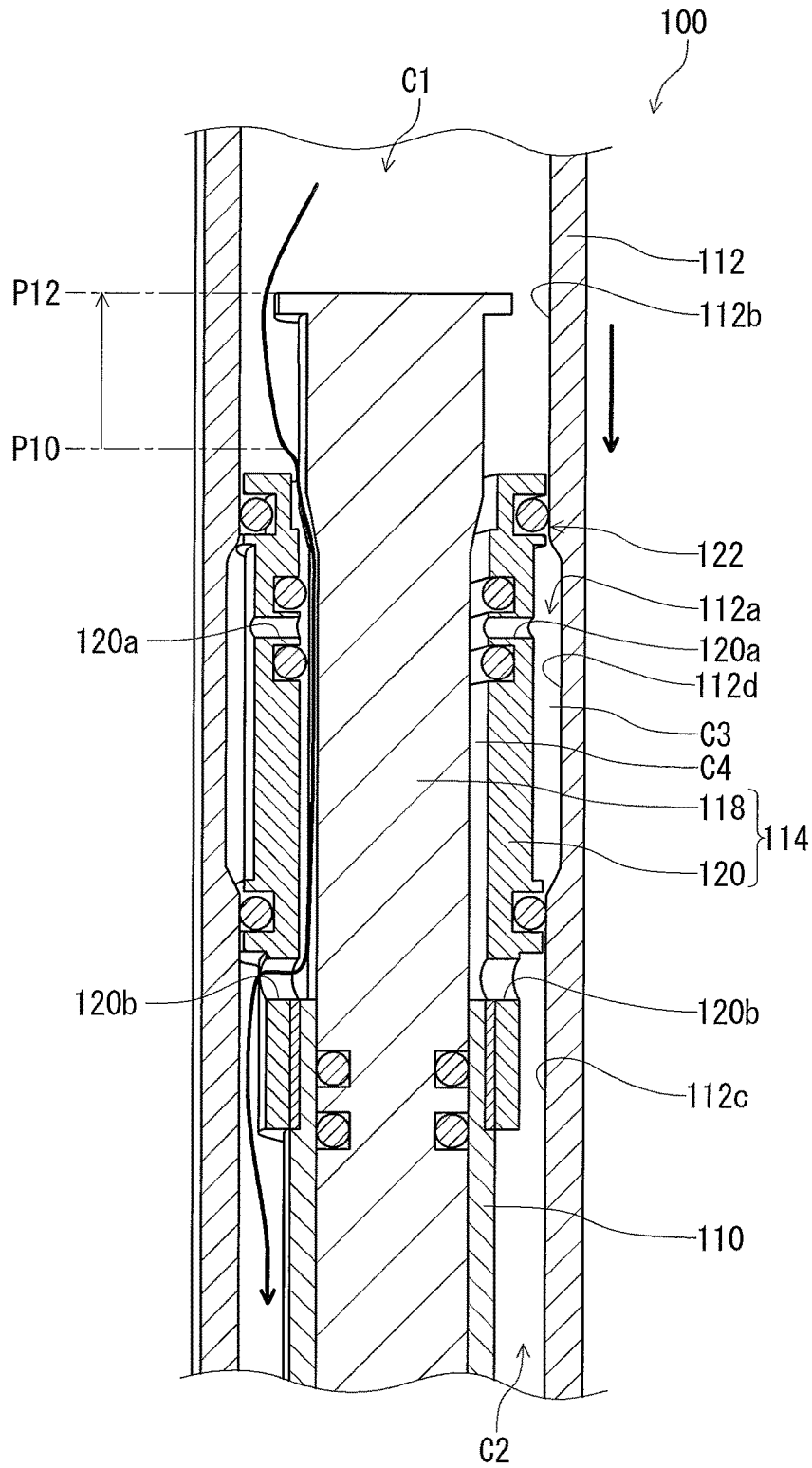


FIG. 14

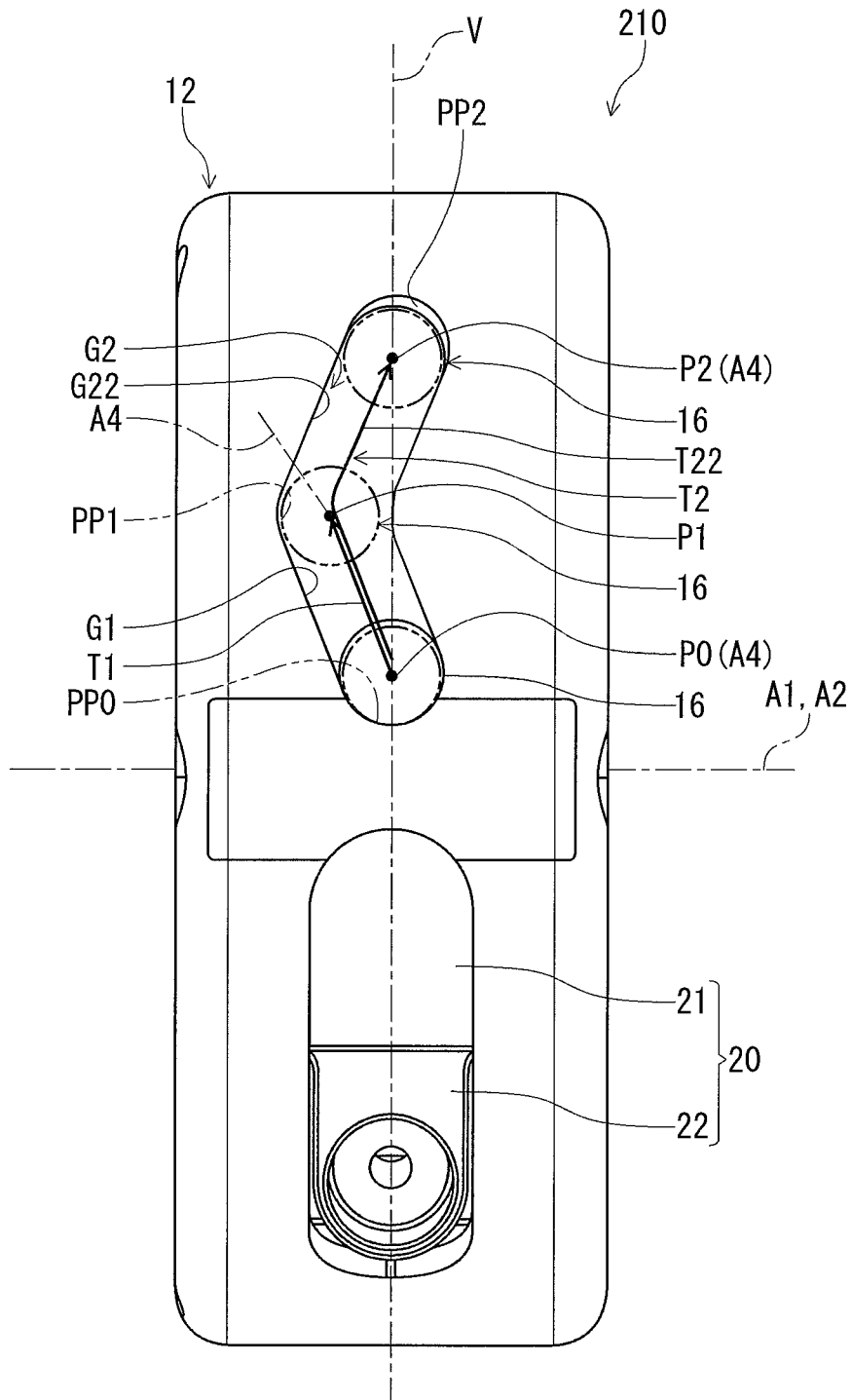


FIG. 15

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BICYCLE OPERATING DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a bicycle operating device.

Discussion of the Background

Bicycling is becoming an increasingly more popular form of recreation as well as a means of transportation. Moreover, bicycling has become a very popular competitive sport for both amateurs and professionals. Whether the bicycle is used for recreation, transportation or competition, the bicycle industry is constantly improving the various components of the bicycle. One bicycle component that has been extensively redesigned is a bicycle operating device.

SUMMARY OF THE INVENTION

In accordance with a first aspect of the present invention, a bicycle operating device comprises a base member and an operated member. The base member is configured to be mounted to a bicycle part. The operated member is configured to be operated by a user to operate a bicycle component via an operation cable. The operated member is configured to be movable relative to the base member from a rest position to a first operated position along a first path such that the operation cable is pulled relative to the base member by a first amount of movement in a cable operating direction. The operated member is configured to be movable relative to the base member from the rest position to a second operated position along a second path such that the operation cable is pulled relative to the base member by a second amount of movement in the cable operating direction. The second path is at least partially different from the first path. The second amount of movement is different from the first amount of movement.

In accordance with a second aspect of the present invention, the bicycle operating device according to the first aspect further comprises a cable operating structure configured to pull the operation cable relative to the base member in the cable operating direction by the first amount of movement when the operated member is moved from the rest position to the first operated position along the first path. The cable operating structure is configured to pull the operation cable relative to the base member in the cable operating direction by the second amount of movement when the operated member is moved from the rest position to the second operated position along the second path.

In accordance with a third aspect of the present invention, the bicycle operating device according to the second aspect is configured so that the cable operating structure is configured to be moved by the operated member in a first direction when the operated member is moved from the rest position to the first operated position. The cable operating structure is configured to be moved by the operated member in the first direction when the operated member is moved from the rest position to the second operated position.

In accordance with a fourth aspect of the present invention, the bicycle operating device according to the third aspect is configured so that the operated member is configured to be slanted by a user in a second direction different from the first direction when the operated member is moved from the rest position to at least one of the first operated position and the second operated position.

In accordance with a fifth aspect of the present invention, the bicycle operating device according to the fourth aspect

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is configured so that the operated member is pivotally coupled to the cable operating structure about a pivot axis.

In accordance with a sixth aspect of the present invention, the bicycle operating device according to the fifth aspect is configured so that the cable operating structure includes a cable supporting member configured to be movable relative to the base member in the first direction to pull the operation cable in the cable operating direction. The operated member is pivotally coupled to the cable supporting member about the pivot axis such that the operated member is configured to be slanted in the second direction.

In accordance with a seventh aspect of the present invention, the bicycle operating device according to the sixth aspect is configured so that the operated member extends along a center axis intersecting with the pivot axis. The first path is defined so as to at least extend from the center axis of when the operated member is disposed at the rest position, to the center axis of when the operated member is disposed at the first operated position. The second path is defined so as to at least extend from the center axis of when the operated member is disposed at the rest position, to the center axis of when the operated member is disposed at the second operated position.

In accordance with an eighth aspect of the present invention, the bicycle operating device according to the sixth aspect is configured so that the cable supporting member is configured to be rotatable relative to the base member about a rotation axis in the first direction.

In accordance with a ninth aspect of the present invention, the bicycle operating device according to the eighth aspect is configured so that the rest position is provided on a virtual plane perpendicular to the rotation axis. At least one of the first operated position and the second operated position is spaced apart from the virtual plane.

In accordance with a tenth aspect of the present invention, the bicycle operating device according to the eighth aspect is configured so that the cable supporting member is configured to be rotatable around a longitudinal axis of the bicycle part.

In accordance with an eleventh aspect of the present invention, the bicycle operating device according to the eighth aspect is configured so that the base member includes a supporting portion configured to rotatably support the cable supporting member about the rotation axis.

In accordance with a twelfth aspect of the present invention, the bicycle operating device according to the sixth aspect further comprises a first biasing member configured to bias the cable supporting member such that the operated member is disposed at the rest position.

In accordance with a thirteenth aspect of the present invention, the bicycle operating device according to the first aspect is configured so that the base member includes a rest positioning portion configured to be contactable with the operated member to position the operated member at the rest position relative to the base member.

In accordance with a fourteenth aspect of the present invention, the bicycle operating device according to the thirteenth aspect is configured so that the base member includes a first positioning portion and a second positioning portion. The first positioning portion is configured to be contactable with the operated member to position the operated member at the first operated position relative to the base member. The second positioning portion is configured to be contactable with the operated member to position the operated member at the second operated position relative to the base member.

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In accordance with a fifteenth aspect of the present invention, the bicycle operating device according to the fourteenth aspect is configured so that the base member includes a first guide portion and a second guide portion. The first guide portion is configured to guide the operated member between the rest positioning portion and the first positioning portion. The second guide portion is configured to guide the operated member between the rest positioning portion and the second positioning portion.

In accordance with a sixteenth aspect of the present invention, the bicycle operating device according to the fifteenth aspect is configured so that the first guide portion is configured to allow the operated member to be moved from the first operated position to the second operated position without via the rest position.

In accordance with a seventeenth aspect of the present invention, the bicycle operating device according to the first aspect is configured so that the operation cable is configured to be connected to a bicycle seatpost assembly to adjust an overall length of the bicycle seatpost assembly. The bicycle seatpost assembly has a first overall length and a second overall length. The first and second overall lengths are different from each other. The overall length of the bicycle seatpost assembly is adjustable to the first overall length in a state where the operated member is positioned at the first operated position such that the operation cable is pulled relative to the base member by the first amount of movement. The overall length of the bicycle seatpost assembly is adjustable to the second overall length in a state where the operated member is positioned at the second operated position such that the operation cable is pulled relative to the base member by the second amount of movement.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a bicycle operating device in accordance with a first embodiment;

FIG. 2 is a cross-sectional view of the bicycle operating device taken along line II-II of FIG. 1;

FIG. 3 is an exploded perspective view of the bicycle operating device illustrated in FIG. 1;

FIG. 4 is a partial exploded perspective view of the bicycle operating device illustrated in FIG. 1;

FIG. 5 is an elevational view of the bicycle operating device illustrated in FIG. 1;

FIG. 6 is a schematic cross-sectional view of the bicycle operating device taken along line VI-VI of FIG. 1 (a first operated position);

FIG. 7 is a schematic cross-sectional view of the bicycle operating device taken along line VII-VII of FIG. 1 (a second operated position);

FIG. 8 is an elevational view of the bicycle operating device illustrated in FIG. 1 (the first operated position);

FIG. 9 is an elevational view of the bicycle operating device illustrated in FIG. 1 (the second operated position);

FIG. 10 is a cross-sectional view of a bicycle seatpost assembly connected to the bicycle operating device illustrated in FIG. 1;

FIG. 11 is a partial cross-sectional view of the bicycle seatpost assembly illustrated in FIG. 10 (a closed position);

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FIG. 12 is a partial cross-sectional view of the bicycle seatpost assembly illustrated in FIG. 10 (a first open position);

FIG. 13 is a partial cross-sectional view of the bicycle seatpost assembly illustrated in FIG. 10 (the first open position);

FIG. 14 is a partial cross-sectional view of the bicycle seatpost assembly illustrated in FIG. 10 (a second open position); and

FIG. 15 is an elevational view of a bicycle operating device in accordance with a second embodiment.

DESCRIPTION OF THE EMBODIMENTS

The embodiments will now be described with reference to the accompanying drawings, wherein like reference numerals designate corresponding or identical elements throughout the various drawings.

First Embodiment

Referring initially to FIG. 1, a bicycle operating device 10 in accordance with a first embodiment is configured to be mounted to a bicycle part B1. Possible examples of the bicycle part B1 include a bicycle handlebar, a stem and a bicycle frame. The bicycle operating device 10 is configured to operate a bicycle component B2 configured to be operated via an operation cable 2. Possible examples of the bicycle component B2 include a seat post assembly and a bicycle transmission. Since such bicycle components are well known in the bicycle field, they will not be described and/or illustrated in detail here for the sake of brevity. The bicycle operating device 10 is a right hand side control device operated by the rider's right hand. It will be apparent to those skilled in the bicycle field that the configuration of the bicycle operating device 10 can be adapted to a left hand side control device that is operated by the rider's left hand.

In the present application, the following directional terms "forward", "rearward", "left", "right", "upward" and "downward" as well as any other similar directional terms refer to those directions which are determined on the basis of the rider who sits on a bicycle seat (not shown) of a bicycle with facing a bicycle handlebar (not shown). Accordingly, these terms, as utilized to describe the bicycle operating device 10, should be interpreted relative to a bicycle equipped with the bicycle operating device 10 as used in an upright riding position on a horizontal surface.

As seen in FIG. 1, the bicycle operating device 10 comprises a base member 12. The base member 12 is configured to be mounted to the bicycle part B1. In the illustrated embodiment, the base member 12 has an annular shape and includes an inner peripheral surface 12a. The inner peripheral surface 12a defines a center opening 12b through which the bicycle part B1 passes. In the illustrated embodiment, the bicycle part B1 has a longitudinal axis A1. The bicycle operating device 10 comprises a clamp member 14 configured to clamp the bicycle part B1 together with the inner peripheral surface 12a of the base member 12.

As seen in FIG. 1, the bicycle operating device 10 comprises an operated member 16. The operated member 16 is configured to be operated by a user to operate the bicycle component B2 via an operation cable 2. The base member 12 includes a guide opening 12c configured to define a movable area of the operated member 16 with respect to the base member 12. The operated member 16 extends through the guide opening 12c.

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As seen in FIG. 2, the bicycle operating device 10 further comprises a cable operating structure 18. The base member 12 includes an inner space 12d having an annular shape. The cable operating structure 18 is provided in the inner space 12d of the base member 12. The cable operating structure 18 is rotatable relative to the base member 12 in a rotational direction D1 about a rotation axis A2. For example, the rotation axis A2 is defined by a center axis of the inner peripheral surface 12a of the base member 12 and is substantially coaxial with the longitudinal axis A1 of the bicycle part B1.

As seen in FIG. 2, the operated member 16 is pivotally coupled to the cable operating structure 18 about a pivot axis A3. The operated member 16 extends along a center axis A4 intersecting with the pivot axis A3. In the illustrated embodiment, the center axis A4 of the operated member 16 is perpendicular to the pivot axis A3. The operated member 16 is rotatable together with the cable operating structure 18 relative to the base member 12 about the rotation axis A2. The pivot axis A3 is defined substantially along the rotational direction D1 of the cable operating structure 18. The pivot axis A3 can be defined to be perpendicular to a radial direction of the inner peripheral surface 12a of the base member 12. The constructions of the operated member 16 and the cable operating structure 18 are not limited to the illustrated embodiment. For example, the operated member 16 can be secured to the cable operating structure 18 if needed and/or desired. Furthermore, the operated member 16 can be slanted in a direction different from the rotational direction D1 together with the cable operating structure 18 with respect to the base member 12 if needed and/or desired.

As seen in FIG. 2, the cable operating structure 18 includes a cable supporting member 20. An end of the operation cable 2 is connected to the cable supporting member 20. More specifically, the cable supporting member 20 includes a cable supporting main-body 21 and a cable attachment portion 22. The cable attachment portion 22 is provided on the cable supporting main-body 21. An end of an inner cable 2a of the operation cable 2 is attached to the cable attachment portion 22. The base member 12 includes a cable guide hole 12e through which the operation cable 2 is to extend. The cable guide hole 12e defines a cable operation axis A5 as a center longitudinal axis thereof.

When the cable operating structure 18 rotates relative to the base member 12 in a first rotational direction D11 of the rotational direction D1, the operation cable 2 (i.e., the inner cable 2a) is pulled from an initial position. When the cable operating structure 18 rotates relative to the base member 12 in a second rotational direction D12 opposite to the first rotational direction D11, the operation cable 2 (i.e., the inner cable 2a) is returned toward the initial position.

As seen in FIG. 3, the base member 12 includes a supporting portion 23 configured to rotatably support the cable supporting member 20 about the rotation axis A2. In the illustrated embodiment, the supporting portion 23 is configured to slidably contact the cable supporting member 20 to rotatably support the cable supporting member 20 about the rotation axis A2. The base member 12 further includes a first housing 24, a second housing 26 and a third housing 27. The second housing 26 is fastened to the first housing 24 by fasteners (not shown) such as a screw. The third housing 27 is fastened to the first housing 24 and the second housing 26 by fasteners (not shown) such as a screw. The first housing 24 has a first annular part 24a and a first cylindrical part 24b. The first annular part 24a has a first opening 24c through which the bicycle part B1 (FIG. 1) is to extend. The first cylindrical part 24b protrudes from an

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outer periphery of the first annular part 24a. The second annular part 26a has a second annular part 26a and a second cylindrical part 26b. The second housing 26 has a second opening 26c through which the bicycle part B1 is to extend. The second cylindrical part 26b protrudes from an outer periphery of the second annular part 26a. The first cylindrical part 24b, the second cylindrical part 26b and the third housing 27 are assembled to provide the guide opening 12c (FIG. 1).

The supporting portion 23 is provided between the first housing 24 and the second housing 26. The supporting portion 23 is secured to the first annular part 24a and the second annular part 26a via protrusions 23a. The supporting portion 23 defines the center opening 12b of the base member 12. The supporting portion 23, the first housing 24, the second housing 26 and the third housing 27 define the inner space 12d (FIG. 2) of the base member 12.

The cable operating structure 18 includes a first sliding part 30 and a second sliding part 32. The cable supporting main-body 21 has a cylindrical shape and is disposed radially outward of the supporting portion 23. The first sliding part 30 is fitted in the cable supporting member 20. The second sliding part 32 is fitted in the cable supporting member 20. The first sliding part 30 is slidable with an outer peripheral surface of the supporting portion 23. The second sliding part 32 is slidable with an outer peripheral surface of the supporting portion 23. The construction of the cable operating structure 18 is not limited to the illustrated embodiment. For example, at least one of the first sliding part 30 and the second sliding part 32 can be slidably provided in the cable supporting main-body 21 if needed and/or desired. Furthermore, at least one of the first sliding part 30 and the second sliding part 32 can be integrally provided with the cable supporting main-body 21 as a single unitary member if needed and/or desired.

As seen in FIG. 3, the cable operating structure 18 further includes a lever coupling structure 34 configured to pivotally couple the operated member 16 to the cable supporting member 20. The lever coupling structure 34 is provided on an outer peripheral surface of the cable supporting member 20. The lever coupling structure 34 includes a first lever supporting part 36 and a second lever supporting part 38. Each of the first lever supporting part 36 and the second lever supporting part 38 radially outwardly protrudes from the cable supporting main-body 21. The second lever supporting part 38 is spaced apart from the first lever supporting part 36 in the rotational direction D1. The operated member 16 is partially provided between the first lever supporting part 36 and the second lever supporting part 38 (FIG. 2). The lever coupling structure 34 further includes a pivot pin 40 configured to pivotally couple the operated member 16 to the first lever supporting part 36 and the second lever supporting part 38. The pivot pin 40 is attached to the first lever supporting part 36 and the second lever supporting part 38.

As seen in FIG. 4, the pivot pin 40 includes a first end 40a and a second end 40b. The first lever supporting part 36 includes a first supporting hole 36a. The second lever supporting part 38 includes a second supporting hole 38a. The first end 40a of the pivot pin 40 is fitted in the first supporting hole 36a. The second end 40b of the pivot pin 40 is fitted in the second supporting hole 38a.

The operated member 16 includes a shaft portion 16a and a head portion 16b provided at an end of the shaft portion 16a. The shaft portion 16a includes a through-hole 16c through which the pivot pin 40 extends. The pivot pin 40 defines the pivot axis A3 of the operated member 16. The

head portion **16b** has an outer maximum diameter larger than an outer maximum diameter of the shaft portion **16a**. The operated member **16** is pivotable relative to the cable supporting member **20** around the pivot axis **A3**.

As seen in FIG. 4, the lever coupling structure **34** further includes a first biasing element **42** and a second biasing element **44**. The first biasing element **42** and the second biasing element **44** are secured to the second lever supporting part **38**. In the illustrated embodiment, each of the first biasing element **42** and the second biasing element **44** is a leaf spring, for example. The structures of the first biasing element **42** and the second biasing element **44** are not limited to the illustrated embodiment. For example, the first biasing element **42** and the second biasing element **44** can be other biasing elements such as a coil spring if needed and/or desired. Furthermore, at least one of the first biasing element **42** and the second biasing element **44** can be omitted if needed and/or desired.

The second lever supporting part **38** includes a first slit **38b** and a second slit **38c**. The first biasing element **42** is partially fitted in the first slit **38b**. The second biasing element **44** is partially fitted in the second slit **38c**. The shaft portion **16a** of the operated member **16** is provided between the first biasing element **42** and the second biasing element **44**. The first biasing element **42** and the second biasing element **44** are configured to elastically position the operated member **16** at a neutral position **Pn**. As seen in FIG. 2, in a state where the operated member **16** is positioned at the neutral position **Pn**, the center axis **A4** of the operated member **16** is substantially perpendicular to the rotational axis **A2**.

As seen in FIG. 5, the operated member **16** is movable within the guide opening **12c** of the base member **12**. The operated member **16** is omitted from FIG. 5 for convenience of explanation. The operated member **16** is configured to be movable relative to the base member **12** from a rest position **P0** to a first operated position **P1** along a first path **T1**. The operated member **16** is configured to be movable relative to the base member **12** from the rest position **P0** to a second operated position **P2** along a second path **T2**. In FIG. 5, each of the rest position **P0**, the first operated position **P1** and the second operated position **P2** is defined based on the center axis **A4** of the operated member **16**.

More specifically, the first path **T1** is defined so as to at least extend from the center axis **A4** of when the operated member **16** is disposed at the rest position **P0**, to the center axis **A4** of when the operated member **16** is disposed at the first operated position **P1**. The second path **T2** is defined so as to at least extend from the center axis **A4** of when the operated member **16** is disposed at the rest position **P0**, to the center axis **A4** of when the operated member **16** is disposed at the second operated position **P2**. The second path **T2** is at least partially different from the first path **T1**. In the illustrated embodiment, the second path **T2** is entirely different from the first path **T1**. The first path **T1** is defined as a path having a minimum travel between the rest position **P0** and the first operated position **P1**, for example. The second path **T2** is defined as a path having a minimum travel between the rest position **P0** and the second operated position **P2**, for example. The rest position **P0** can be defined as a point at which the first path **T1** and the second path **T2** intersect with each other. In the illustrated embodiment, the second path **T2** is defined on a plane which is not parallel to a plane on which the first path **T1** is defined.

In the present application, the term “rest position” as used herein refers to a position at which a movable part (e.g., the operated member **16**) remains stationary in a state where the

movable part is not operated by a user (e.g., a rider). The term “operated position” as used herein refers to a position at which the movable part has been operated by a user (e.g., a rider) to perform the operation of the bicycle component **B2**.

As seen in FIG. 5, the rest position **P0** is provided on a virtual plane **V** perpendicular to the rotation axis **A2**. At least one of the first operated position **P1** and the second operated position **P2** is spaced apart from the virtual plane **V**. In the illustrated embodiment, each of the first operated position **P1** and the second operated position **P2** is spaced apart from the virtual plane **V**. The first operated position **P1** is disposed on an opposite side of the second operated position **P2** with respect to the virtual plane **V**. However, one of the first operated position **P1** and the second operated position **P2** can be disposed on the virtual plane **V** if needed and/or desired. Furthermore, both of the first operated position **P1** and the second operated position **P2** can be disposed on the same side with respect to the virtual plane **V** if needed and/or desired.

As seen in FIG. 5, the base member **12** includes a rest positioning portion **PP0**, a first positioning portion **PP1** and a second positioning portion **PP2**. The rest positioning portion **PP0** is configured to be contactable with the operated member **16** to position the operated member **16** at the rest position **P0** relative to the base member **12**. The first positioning portion **PP1** is configured to be contactable with the operated member **16** to position the operated member **16** at the first operated position **P1** relative to the base member **12**. The second positioning portion **PP2** is configured to be contactable with the operated member **16** to position the operated member **16** at the second operated position **P2** relative to the base member **12**.

The base member **12** includes a first guide portion **G1** and a second guide portion **G2**. The first guide portion **G1** is configured to guide the operated member **16** between the rest positioning portion **PP0** and the first positioning portion **PP1**. The second guide portion **G2** is configured to guide the operated member **16** between the rest positioning portion **PP0** and the second positioning portion **PP2**. The first guide portion **G1** is configured to allow the operated member **16** to be moved from the first operated position **P1** to the second operated position **P2** without via the rest position **P0**. More specifically, the operated member **16** is configured to be movable relative to the base member **12** from the first operated position **P1** to the second operated position **P2** along a third path **T3**. The third path **T3** is partially the same as the second path **T2**.

The second guide portion **G2** is on an opposite side of the first guide portion **G1** in the guide opening **12c**. The operated member **16** is movable relative to the base member **12** between the first guide portion **G1** and the second guide portion **G2**. The base member **12** further includes a third guide portion **G3** configured to guide the operated member **16** between the first operated position **P1** and the second operated position **P2**. The third guide portion **G3** is configured to allow the operated member **16** to be moved from the second operated position **P2** to the first operated position **P1** without via the rest position **P0**. The rest positioning portion **PP0**, the first positioning portion **PP1**, the second positioning portion **PP2**, the first guide portion **G1**, the second guide portion **G2** and the third guide portion **G3** define the guide opening **12c** of the base member **12**.

As seen in FIGS. 5 and 6, the operated member **16** is configured to be movable relative to the base member **12** from the rest position **P0** to the first operated position **P1** along the first path **T1** such that the operation cable **2** is

pulled relative to the base member **12** by a first amount of movement **M1** in a cable operating direction **D2**. The cable operating structure **18** is configured to pull the operation cable **2** relative to the base member **12** in the cable operating direction **D2** by the first amount of movement **M1** when the operated member **16** is moved from the rest position **P0** to the first operated position **P1** along the first path **T1**. The cable operating direction **D2** is defined as a direction parallel to the cable operation axis **A5** of the cable guide hole **12e**, for example.

As seen in FIGS. **5** and **7**, the operated member **16** is configured to be movable relative to the base member **12** from the rest position **P0** to the second operated position **P2** along the second path **T2** such that the operation cable **2** is pulled relative to the base member **12** by a second amount of movement **M2** in the cable operating direction **D2**. The cable operating structure **18** is configured to pull the operation cable **2** relative to the base member **12** in the cable operating direction **D2** by the second amount of movement **M2** when the operated member **16** is moved from the rest position **P0** to the second operated position **P2** along the second path **T2**.

As seen in FIGS. **6** and **7**, the second amount of movement **M2** is different from the first amount of movement **M1**. In the illustrated embodiment, the second amount of movement **M2** is greater than the first amount of movement **M1**. However, the second amount of movement **M2** can be less than the first amount of movement **M1** if needed and/or desired.

As seen in FIG. **6**, the first positioning portion **PP1** and the rest positioning portion **PP0** are configured to define a first rotation angle **R1** of the cable operating structure **18** relative to the base member **12** about the rotation axis **A2**. The first positioning portion **PP1** and the rest positioning portion **PP0** are configured to define the first amount of movement **M1** of the operation cable **2** in the cable operating direction **D2**.

As seen in FIG. **7**, the second positioning portion **PP2** and the rest positioning portion **PP0** are configured to define a second rotation angle **R2** of the cable operating structure **18** relative to the base member **12** about the rotation axis **A2**. The second rotation angle **R2** is greater than the first rotation angle **R1**. The second positioning portion **PP2** and the rest positioning portion **PP0** are configured to define the second amount of movement **M2** of the operation cable **2** in the cable operating direction **D2**.

As seen in FIGS. **5** and **6**, the cable operating structure **18** is configured to be moved by the operated member **16** in a first direction when the operated member **16** is moved from the rest position **P0** to the first operated position **P1**. In the illustrated embodiment, the first direction is defined as the first rotational direction **D11** of the rotational direction **D1**. The first direction can be defined as directions other than the first rotational direction **D11**. The first rotational direction **D11** is hereinafter referred to as the first direction **D11**. The cable supporting member **20** is configured to be rotatable relative to the base member **12** about the rotation axis **A2** in the first direction **D11**. In other words, the cable supporting member **20** is configured to be rotatable relative to the base member **12** around the longitudinal axis **A1** of the bicycle part **B1**.

As seen in FIGS. **5** and **6**, the cable operating structure **18** is configured to be moved by the operated member **16** in the first direction **D11** when the operated member **16** is moved from the rest position **P0** to the second operated position **P2**. The cable supporting member **20** is configured to be mov-

able relative to the base member **12** in the first direction **D11** to pull the operation cable **2** in the cable operating direction **D2**.

As seen in FIGS. **8** and **9**, the operated member **16** is configured to be slanted by a user in a second direction **D3** different from the first direction **D11** when the operated member **16** is moved from the rest position **P0** to at least one of the first operated position **P1** and the second operated position **P2**. In the illustrated embodiment, the operated member **16** is configured to be slanted by a user in the second direction **D3** when the operated member **16** is moved from the rest position **P0** to each of the first operated position **P1** and the second operated position **P2**.

As seen in FIGS. **2**, **8** and **9**, the second direction **D3** is defined as a pivot direction in which the operated member **16** is pivotable relative to the cable operating structure **18** around the pivot axis **A3**. The operated member **16** is pivotally coupled to the cable supporting member **20** about the pivot axis **A3** such that the operated member **16** is configured to be slanted in the second direction **D3**.

Returning to FIG. **2**, the bicycle operating device **10** further comprises a first biasing member **46** configured to bias the cable supporting member **20** such that the operated member **16** is disposed at the rest position **P0**. In the illustrated embodiment, the first biasing member **46** is a tension coil spring. However, the first biasing member **46** can be a biasing member other than the tension coil spring if needed and/or desired.

The cable operating structure **18** includes a first spring support **48** radially outwardly protruding from the cable supporting main-body **21**. The base member **12** includes a second spring support **50** spaced apart from the first spring support **48** in the rotational direction **D1**. A first end portion **46a** of the first biasing member **46** is hooked to the first spring support **48**. A second end portion **46b** of the first biasing member **46** is hooked to the second spring support **50**.

As seen in FIG. **2**, the first biasing member **46** is configured to bias the cable operating structure **18** to rotate relative to the base member **12** in the second rotational direction **D12**. As seen in FIG. **5**, the operated member **16** is pressed against the rest positioning portion **PP0** in a state where the cable operating structure **18** is biased to rotate relative to the base member **12** in the second rotational direction **D12**. This causes the operated member **16** to be positioned at the rest position **P0**. However, the first biasing member **46** can be omitted from the bicycle operating device **10** if needed and/or desired. The first biasing member **46** can be provided in a bicycle component operated using the bicycle operating device **10** if needed and/or desired.

The bicycle operating device **10** can be used to operate several bicycle components. One example of the bicycle component **B2** will be described below referring to FIGS. **10** to **14**.

As seen in FIG. **10**, the bicycle operating device **10** can be used to operate a bicycle seatpost assembly **100** via the operation cable **2**, for example. The operation cable **2** is configured to be connected to the bicycle seatpost assembly **100** to adjust an overall length of the bicycle seatpost assembly **100**. The bicycle seatpost assembly **100** has a maximum overall length **L0** and a minimum overall length **L3**. The overall length of the bicycle seatpost assembly **100** is adjustable within an adjustable range **AR** defined as a difference between the maximum overall length **L0** and the minimum overall length **L3**. The bicycle seatpost assembly **100** has a first overall length **L1** and a second overall length **L2**. The first overall length **L1** and the second overall length

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L2 are defined between the maximum overall length L0 and the minimum overall length L3. The first and second overall lengths L1 and L2 are different from each other.

For example, the overall length of the bicycle seatpost assembly 100 is adjustable to the first overall length L1 in a state where the operated member 16 is positioned at the first operated position P1 such that the operation cable 2 is pulled relative to the base member 12 by the first amount of movement M1 (FIG. 6). The overall length of the bicycle seatpost assembly 100 is adjustable to the second overall length L2 in a state where the operated member 16 is positioned at the second operated position P2 such that the operation cable 2 is pulled relative to the base member 12 by the second amount of movement M2 (FIG. 7).

In the illustrated embodiment, the bicycle seatpost assembly 100 has a locked state, a first adjustable state and a second adjustable state. The bicycle seatpost assembly 100 has a structure switchable a state of the bicycle seatpost assembly 100 between the locked state, the first adjustable state and the second adjustable state using the bicycle operating device 10.

For example, in the locked state, the overall length of the bicycle seatpost assembly 100 is maintained at an adjusted overall length. In the first adjustable state, the overall length of the bicycle seatpost assembly 100 is adjustable to the first overall length L1 by just operating the operated member 16 to the first operated position P1. More specifically, in the first adjustable state, the second cylinder 104 stops relative to the first cylinder 102 at a position corresponding to the first overall length L1 when the second cylinder 104 downwardly moves relative to the first cylinder 102 from a position corresponding to the maximum overall length L0. Furthermore, in the first adjustable state, the overall length of the bicycle seatpost assembly 100 is continuously adjustable between the maximum overall length L0 and the first overall length L1 by operating the operated member 16 to the first operated position P1. In the second adjustable state, the overall length of the bicycle seatpost assembly 100 is continuously adjustable within the adjustable range AR by operating the operated member 16 to the second operated position P2. In the illustrated embodiment, the second overall length L2 shows possible overall lengths within the adjustable range AR while the first overall length L1 is a predetermined overall length.

As seen in FIG. 10, the bicycle seatpost assembly 100 includes a first cylinder 102 and a second cylinder 104. The first cylinder 102 is detachably attached to a seat tube (not shown), for example. However, the second cylinder 104 can be detachably attached to the seat tube if needed and/or desired. The second cylinder 104 is configured to be telescopically received in the first cylinder 102. The first cylinder 102 and the second cylinder 104 are configured to be movable relative to each other in a telescopic direction D10. The second cylinder 104 includes a seat attachment portion 106 to which a bicycle seat (not shown) is to be attached.

As seen in FIG. 10, the bicycle seatpost assembly 100 further includes a positioning structure 108. The positioning structure 108 is configured to switch a state of the bicycle seatpost assembly 100 among the locked state, the first adjustable state and the second adjustable state. The positioning structure 108 includes a first inner tube 110, a second inner tube 112, and a valve structure 114. The first inner tube 110 and the second inner tube 112 extend in the telescopic direction D10. The first inner tube 110 is provided in the first cylinder 102 and is integrally movable with the first cylinder 102. The second inner tube 112 is provided in the second cylinder 104 and is integrally movable with the second

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cylinder 104. The valve structure 114 has a closed state, a first open state and a second open state. The closed state corresponds to the locked state. The first open state corresponds to the first adjustable state. The second open state corresponds to the second adjustable state.

In the locked state, the first cylinder 102 and the second cylinder 104 are fixedly positioned relative to each other in the telescopic direction D10. In the first adjustable state, the first cylinder 102 and the second cylinder 104 are telescopically movable relative to each other between the maximum overall length L0 and the first overall length L1 in the telescopic direction D10. In the second adjustable state, the first cylinder 102 and the second cylinder 104 are telescopically movable relative to each other between the maximum overall length L0 and the minimum overall length L3 in the telescopic direction D10. The bicycle seatpost assembly 100 includes a valve operating structure 116 attached to a lower end of the first cylinder 102. The valve operating structure 116 is operatively connected to the bicycle operating device 10 via the operation cable 2.

As seen in FIG. 11, the valve structure 114 includes a valve body 118 and a valve receiving member 120. The valve receiving member 120 is secured to an upper end of the first inner tube 110 and is slidably provided in the second inner tube 112. A first chamber C1 is defined by the second inner tube 112, the valve body 118 and the valve receiving member 120. A second chamber C2 is defined by the second inner tube 112, the valve receiving member 120 and the first inner tube 110. Each of the first chamber C1 and the second chamber C2 is filled with a substantially incompressible fluid (e.g., oil), for example.

The valve body 118 is slidably provided in the first inner tube 110 and the valve receiving member 120. The valve body 118 is configured to be positioned at a closed position P10, a first open position P11 and a second open position P12. In the closed state of the valve structure 114, the valve body 118 is positioned at the closed position P10. In the first open state of the valve structure 114, the valve body 118 is positioned at the first open position P11. In the second open state of the valve structure 114, the valve body 118 is positioned at the second open position P12.

The valve body 118 contacts the valve receiving member 120 to close the valve structure 114 in a state where the valve body 118 is positioned at the closed position P10. The closed position P10 corresponds to the rest position P0 (FIGS. 5 and 10) of the bicycle operating device 10. The first open position P11 corresponds to the first operated position P1 (FIGS. 5, 6 and 10) of the bicycle operating device 10. The second open position P12 corresponds to the second operated position P2 (FIGS. 5, 7 and 10) of the bicycle operating device 10.

As seen in FIG. 11, in a state where the overall length of the bicycle seatpost assembly 100 is the maximum overall length L0, a seal member 122 is disposed radially inward of a recess 112a provided in the second inner tube 112. The second inner tube 112 includes a first inner peripheral surface 112b, a second inner peripheral surface 112c and a recessed inner peripheral surface 112d. The recessed inner peripheral surface 112d defines the recess 112a. The recessed inner peripheral surface 112d is disposed between the first inner peripheral surface 112b and the second inner peripheral surface 112c. The seal member 122 is spaced apart from the recessed inner peripheral surface 112d of the second inner tube 112 to provide a passageway W1 between the recessed inner peripheral surface 112d and the seal member 122.

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As seen in FIG. 12, when the operated member 16 of the bicycle operating device 10 is moved by the user from the rest position P0 to the first operated position P1, the valve body 118 is moved from the closed position P10 to the first open position P11. In a state where the valve body 118 is positioned at the first open position P11, the first chamber C1 is in communication with the second chamber C2 via a first intermediate chamber C3, first through-holes 120a, a second intermediate chamber C4 and second through-holes 120b. This allows the substantially incompressible fluid to flow from the first chamber C1 to the second chamber C2, allowing the second cylinder 104 to be downwardly moved relative to the first cylinder 102 using the rider's weight applied to the seat attachment portion 106.

As seen in FIG. 13, after the seal member 122 passes through the recess 112a, the seal member 122 contacts the first inner peripheral surface 112b of the second inner tube 112. This prevents the substantially incompressible fluid from flowing from the first chamber C1 to the second chamber C2, causing the second cylinder 104 to stop moving relative to the first cylinder 102 and to be fixedly positioned relative to the first cylinder 102 at a position corresponding to the first overall length L1 (FIG. 10). Accordingly, when the operated member 16 of the bicycle operating device 10 is moved to the first operated position P1, the second cylinder 104 downwardly moves relative to the first cylinder 102 from the maximum overall length L0 to the first overall length L1 defined by the recess 112a.

As seen FIG. 14, when the operated member 16 is moved by the user from the rest position P0 to the second operated position P2, the valve body 118 is moved from the closed position P10 to the second open position P12. In a state where the valve body 118 is positioned at the second open position P12, the first chamber C1 is in communication with the second chamber C2 via the second intermediate chamber C4 and the second through-holes 120b. This allows the substantially incompressible fluid to flow from the first chamber C1 to the second chamber C2, allowing the second cylinder 104 to be downwardly moved relative to the first cylinder 102 using the rider's weight applied to the seat attachment portion 106.

At this time, the substantially incompressible fluid flows from the first chamber C1 to the second chamber C2 without via the first intermediate chamber C3. Accordingly, a relative position between the first cylinder 102 and the second cylinder 104 can be continuously adjusted using the bicycle operating device 10 regardless of the recess 112a.

Since the bicycle seatpost assembly 100 includes structures which are well known in the bicycle field, they will not be described and/or illustrated in detail here for the sake of brevity. The bicycle component B2 operated using the bicycle operating device 10 is not limited to the bicycle seatpost assembly 100. The bicycle operating device 10 can be used to operate bicycle components other than the bicycle seatpost assembly 100 if needed and/or desired.

The bicycle seatpost assembly 100 is not limited to a hydraulic adjustable seatpost such that an overall length thereof is continuously adjustable. In a case where the bicycle operating device 10 is applied to a seatpost assembly, the seatpost assembly can include a mechanical structure such that an overall length thereof is mechanically adjustable to a plurality of predetermined different lengths instead of a hydraulic mechanism.

With the bicycle operating device 10, the operated member 16 is configured to be movable relative to the base member 12 from the rest position P0 to the first operated position P1 along the first path T1 such that the operation

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cable 2 is pulled relative to the base member 12 by the first amount of movement M1 in the cable operating direction D2. Furthermore, the operated member 16 is configured to be movable relative to the base member 12 from the rest position P0 to the second operated position P2 along the second path T2 such that the operation cable 2 is pulled relative to the base member 12 by the second amount of movement M2 in the cable operating direction D2. The second path T2 is at least partially different from the first path T1. The second amount of movement M2 is different from the first amount of movement M1. Accordingly, the operation cable 2 can be pulled by each of the first amount of movement M1 and the second amount of movement M2 in response to operations of a single operated member (i.e., the operated member 16). This allows the structure of the bicycle operating device 10 to be simplified.

Second Embodiment

A bicycle operating device 210 in accordance with a second embodiment will be described below referring to FIG. 15. The bicycle operating device 210 has substantially the same configuration as the bicycle operating device 10 except for a shape of the guide opening. Thus, elements having substantially the same function as those in the first embodiment will be numbered the same here, and will not be described and/or illustrated again in detail here for the sake of brevity.

In the bicycle operating device 210, the second path T2 is at least partially different from the first path T1. In the illustrated embodiment, the second path T2 is partially different from the first path T1 and is partially the same as the first path T1. The second path T2 includes the first path T1 and an additional path T22. The additional path T22 is defined from the first operated position P1 to the second operated position P2.

At least one of the first operated position P1 and the second operated position P2 is spaced apart from the virtual plane V. In the illustrated embodiment, the second operated position P2 is disposed on the virtual plane V while the first operated position P1 is spaced apart from the virtual plane V.

The second guide portion G2 is configured to guide the operated member 16 between the rest positioning portion PP0 and the second positioning portion PP2. In the illustrated embodiment, the second guide portion G2 includes the first guide portion G1 and an additional guide portion G22. The additional guide portion G22 is configured to guide the operated member 16 between the first positioning portion PP1 and the second positioning portion PP2. The first guide portion G1 is configured to allow the operated member 16 to be moved from the first operated position P1 to the second operated position P2 without via the rest position P0.

With the bicycle operating device 210, the operation cable 2 can be pulled by each of the first amount of movement M1 (FIG. 6) and the second amount of movement M2 (FIG. 7) in response to operations of a single operated member (i.e., the operated member 16). This allows the structure of the bicycle operating device 210 to be simplified as well as the bicycle operating device 10 in accordance with the first embodiment.

In the present application, the term "attached" or "attaching", as used herein, encompasses configurations in which an element directly attached to another element by affixing the element is directly to the other element; configurations in which the element is indirectly attached to the other element

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via the intermediate member(s); and configurations in which one element is integral with another element, i.e. one element is essentially part of the other element. This concept also applies to words of similar meaning, for example, “joined”, “connected”, “coupled”, “mounted”, “bonded”, “fixed” and their derivatives.

The term “comprising” and its derivatives, as used herein, are intended to be open ended terms that specify the presence of the stated features, elements, components, groups, integers, and/or steps, but do not exclude the presence of other unstated features, elements, components, groups, integers and/or steps. This concept also applies to words of similar meaning, for example, the terms “have”, “include” and their derivatives.

The terms “member”, “section”, “portion”, “part” and “element” when used in the singular can have the dual meaning of a single part or a plurality of parts.

The ordinal numbers such as “first” and “second” recited in the present application are merely identifiers, but do not have any other meanings, for example, a particular order and the like. Moreover, for example, the term “first element” itself does not imply an existence of “second element”, and the term “second element” itself does not imply an existence of “first element.”

The term “pair of”, as used herein, can encompass the configuration in which the pair of elements have different shapes or structures from each other in addition to the configuration in which the pair of elements have the same shapes or structures as each other.

Finally, terms of degree such as “substantially”, “about” and “approximately” as used herein mean a reasonable amount of deviation of the modified term such that the end result is not significantly changed.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed is:

1. A bicycle operating device comprising:
 a base member configured to be mounted to a bicycle part, the base member including a first guide portion and a second guide portion, the first guide portion defining a first path that extends from a rest positioning portion to a first positioning portion, the second guide portion defining a second path that extends from the rest positioning portion to a second positioning portion; and an operated member configured to be operated by a user to operate a bicycle component via an operation cable, the operated member being configured to be movable relative to the base member from a rest position defined by the rest positioning portion to a first operated position defined by the first positioning portion along the first path such that the operation cable is pulled relative to the base member by a first amount of movement in a cable operating direction, the operated member being configured to be movable relative to the base member from the rest position to a second operated position defined by the second positioning portion along the second path such that the operation cable is pulled relative to the base member by a second amount of movement in the cable operating direction, the second path being at least partially different from the first path, the second amount of movement being different from the first amount of movement,
 wherein the first positioning portion is contactable with the operated member to position the operated member

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at the first operated position, the second positioning portion being contactable with the operated member to position the operated member at the second operated position.

2. The bicycle operating device according to claim 1, further comprising:

a cable operating structure configured to pull the operation cable relative to the base member in the cable operating direction by the first amount of movement when the operated member is moved from the rest position to the first operated position along the first path, and configured to pull the operation cable relative to the base member in the cable operating direction by the second amount of movement when the operated member is moved from the rest position to the second operated position along the second path.

3. The bicycle operating device according to claim 2, wherein

the cable operating structure includes a cable supporting member configured to be rotatable relative to the base member about a rotation axis,

the operated member is coupled to the cable supporting member, and

the cable supporting member and the operated member are configured to be rotated together about the rotation axis relative to the base member when the operated member is moved from the rest position to each of the first operated position and the second operated position relative to the base member.

4. The bicycle operating device according to claim 2, wherein

the cable operating structure is configured to be moved by the operated member in a first direction when the operated member is moved from the rest position to the first operated position, and

the cable operating structure is configured to be moved by the operated member in the first direction when the operated member is moved from the rest position to the second operated position.

5. The bicycle operating device according to claim 4, wherein

the operated member is configured to be slanted by a user in a second direction different from the first direction when the operated member is moved from the rest position to at least one of the first operated position and the second operated position.

6. The bicycle operating device according to claim 5, wherein

the operated member is pivotally coupled to the cable operating structure about a pivot axis.

7. The bicycle operating device according to claim 6, wherein

the cable operating structure includes a cable supporting member configured to be movable relative to the base member in the first direction to pull the operation cable in the cable operating direction, and

the operated member is pivotally coupled to the cable supporting member about the pivot axis such that the operated member is configured to be slanted in the second direction.

8. The bicycle operating device according to claim 7, wherein

the operated member extends along a center axis intersecting with the pivot axis,

the first path is defined so as to at least extend from the center axis of when the operated member is disposed at the rest position,

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to the center axis of when the operated member is disposed at the first operated position, and the second path is defined so as to at least extend from the center axis of when the operated member is disposed at the rest position,

to the center axis of when the operated member is disposed at the second operated position.

9. The bicycle operating device according to claim 7, wherein

the cable supporting member is configured to be rotatable relative to the base member about a rotation axis in the first direction.

10. The bicycle operating device according to claim 9, wherein

the rest position is provided on a virtual plane perpendicular to the rotation axis, and

at least one of the first operated position and the second operated position is spaced apart from the virtual plane.

11. The bicycle operating device according to claim 9, wherein

the cable supporting member is configured to be rotatable around a longitudinal axis of the bicycle part, and the rotation axis substantially coincides with the longitudinal axis of the bicycle part in a state where the base member is mounted to the bicycle part.

12. The bicycle operating device according to claim 9, wherein

the base member includes a supporting portion configured to rotatably support the cable supporting member about the rotation axis.

13. The bicycle operating device according to claim 7, further comprising:

a first biasing member configured to bias the cable supporting member such that the operated member is disposed at the rest position.

14. The bicycle operating device according to claim 1, wherein

the base member includes a rest positioning portion configured to be contactable with the operated member to position the operated member at the rest position relative to the base member.

15. The bicycle operating device according to claim 14, wherein

the first positioning portion and the rest positioning portion are configured to define the first amount of movement of the operation cable in the cable operating direction, and

the second positioning portion and the rest positioning portion are configured to define the second amount of movement of the operation cable in the cable operating direction.

16. The bicycle operating device according to claim 1, wherein

the first guide portion is configured to allow the operated member to be moved from the first operated position to the second operated position without via the rest position.

17. The bicycle operating device according to claim 1, wherein

the operation cable is configured to be connected to a bicycle seatpost assembly to adjust an overall length of the bicycle seatpost assembly,

the bicycle seatpost assembly has a first overall length and a second overall length, the first and second overall lengths being different from each other,

the overall length of the bicycle seatpost assembly is adjustable to the first overall length in a state where the

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operated member is positioned at the first operated position such that the operation cable is pulled relative to the base member by the first amount of movement, and

the overall length of the bicycle seatpost assembly is adjustable to the second overall length in a state where the operated member is positioned at the second operated position such that the operation cable is pulled relative to the base member by the second amount of movement.

18. The bicycle operating device according to claim 1, wherein

the operated member is configured to be movable relative to the base member from the rest position to the first operated position along the first path by a third amount of movement,

the operated member is configured to be movable relative to the base member from the rest position to the second operated position along the second path by a fourth amount of movement, and

the third amount of movement is different from the fourth amount of movement.

19. The bicycle operating device according to claim 18, wherein

the second amount of movement of the operation cable is greater than the first amount of movement of the operation cable, and

the fourth amount of movement of the operated member is greater than the third amount of movement of the operated member.

20. The bicycle operating device according to claim 1, wherein

the cable operating structure includes a cable supporting member configured to be rotatable relative to the base member about a rotation axis,

the cable supporting member has an outer periphery defined about the rotation axis, and

the operated member is pivotally coupled to the outer periphery of the cable supporting member about a pivot axis.

21. The bicycle operating device according to claim 20, wherein

the base member includes a guide opening through which the operated member extends, and

the first positioning portion and the second positioning portion are provided around the guide opening to at least partially define the guide opening.

22. The bicycle operating device according to claim 1, wherein

the first amount of movement of the operation cable is constant, and

the second amount of movement of the operation cable is constant.

23. The bicycle operating device according to claim 1, wherein

the base member further includes a third guide portion defining a third path that extends from the first operated position to the second operated position.

24. The bicycle operating device according to claim 1, wherein

the first guide portion includes a first wall that extends from a first end of the first guide portion to a second end of the first guide portion, and

the second guide portion includes a second wall that extends from a first end of the second guide portion to a second end of the second guide portion.

25. The bicycle operating device according to claim 1,
wherein
the operated member is pivotally mounted in relation to
the base member about a pivot axis,
the first path includes a first portion that extends toward 5
the first positioning portion in a first direction,
the second path includes a second portion that extends
toward the second positioning portion in a second
direction, and
the first direction is not parallel to the second direction 10
when viewed in a direction perpendicular to the pivot
axis.

26. The bicycle operating device according to claim 1,
wherein
the first path extends a first length from the rest position- 15
ing portion to the first positioning portion,
the second path extends a second length from the rest
positioning portion to the second positioning portion,
and
the first length is different from the second length. 20

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