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ELECTRONIC PEN

Abstract

Provided is an electronic pen including a tubular first casing having an opening on a pen tip side, and a tubular second casing rotatably coupled to the first casing with an axial direction of the first casing as a center to receive an instruction of a user, on a side of the first casing opposite to the pen tip side in the axial direction. The first casing includes a first circuit board having a first circuit including a circuit that performs signal interaction with a position detecting sensor. The second casing includes a second circuit board having a second circuit. The first and second circuit boards are electrically connected to each other by a flexible cable disposed in a state of having a surplus portion that can be extended is extendable or contractable in the axial direction and is twistable in a rotational direction about the axial direction.

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Background/Summary

BACKGROUND

Technical Field

[0001] The present disclosure relates to an electronic pen that performs position indication input by performing signal interaction with a position detecting sensor.

Description of the Related Art

[0002] An electronic pen includes, within a casing, a circuit board provided with a circuit for performing signal interaction with a position detecting sensor. Provided on the circuit board are not only the circuit for performing signal interaction with the position detecting sensor but also a circuit for detecting a pen pressure applied to a pen tip of the electronic pen and another additional circuit or peripheral circuit.

[0003] Moreover, recently, the electronic pen has been reduced in thickness, and a part having main functions (including at least a function of performing signal interaction with the position detecting sensor) of the electronic pen has been formed as a module or a cartridge for the convenience of mass production (see Japanese Patent Laid-Open No. 2021-185544, Japanese Patent No. 6359790, and the like). In the following, the part that is formed as a module or a cartridge and has the main functions of the electronic pen will be referred to as an electronic pen main body unit.

[0004] Now, there are many cases where the addition of a new function to the electronic pen or the changing of a function of the electronic pen is requested. In such cases, it is not easy to make such a change that a circuit for effecting the addition or changing of a function as described above is provided to the existing electronic pen main body unit. In general, it is necessary to create a circuit board for which circuit design is newly made again. In addition, a new electronic pen main body unit is generally re-created in a case of an electronic pen using an electronic pen main body unit formed as a module or a cartridge.

[0005] However, this renders the existing circuit board and the electronic pen main body unit formed as a module or a cartridge completely useless, and consequently causes a high cost.

[0006] In addition, in a case where the function to be added or changed involves an operation instruction by a user, it has been a common practice in the existing technology to add an operating unit such as a push-button switch or a slide switch for the operation instruction. However, in cases of adding a new operating unit, a configuration becomes complex, where to arrange these operating units becomes a problem, and there is also a disadvantage in that the addition is not desirable in terms of operability.

BRIEF SUMMARY

[0007] Embodiments of the present disclosure provide a position indicator that can solve the above problems.

[0008] In order to solve the above problems, there is provided an electronic pen including a first casing that is tubular and has an opening on a pen tip side of the first casing, and a second casing that is tubular and configured to be rotatably coupled to the first casing with an axial direction of the first casing as a center to receive an instruction of a user, on a side of the first casing opposite to

the pen tip side of the first casing in the axial direction of the first casing. The first casing includes a first circuit board provided with a first circuit including a circuit that, in operation, performs signal interaction with a position detecting sensor. The second casing includes a second circuit board provided with a second circuit connected to the first circuit. The first circuit board and the second circuit board are electrically connected to each other by a flexible cable disposed in a state of having a surplus portion that is extendable or contractable in the axial direction of the first casing and is twistable in a rotational direction about the axial direction of the first casing.

[0009] The electronic pen having the above-described configuration includes the first casing that is tubular and has the opening on the pen tip side of the first casing, and the second casing coupled to the side of the first casing opposite to the pen tip side of the first casing in the axial direction of the first casing. Moreover, the first casing includes the first circuit board provided with the first circuit including the circuit for performing signal interaction with the position detecting sensor, the second casing includes the second circuit board provided with the second circuit connected to the first circuit, and the first circuit board and the second circuit board are electrically connected to each other by the flexible cable.

[0010] Since a circuit board is thus divided into the first circuit board and the second circuit board, a circuit part for an additional function can be formed on the second circuit board, and the first circuit board can be formed by using an existing circuit board as it is or slightly reworking the existing circuit board.

[0011] Moreover, the electronic pen having the above-described configuration is configured such that an operation for a predetermined instruction by the user is performed by rotating the second casing about the axial direction of the first casing with respect to the first casing. Hence, a new operating unit such as a push-button switch for the operation is rendered unnecessary.

[0012] Moreover, in the electronic pen having the above-described configuration, the first circuit board and the second circuit board are electrically connected to each other by the flexible cable, and the flexible cable has the surplus portion capable of being extended and contracted in the axial direction, and is disposed in a state of being able to be twisted in a rotational direction about the axial direction.

[0013] Hence, even when the second casing is rotated about the axial direction with respect to the first casing, a displacement caused to the flexible cable by the rotation is accommodated by the surplus portion and a twisted part. Thus, the electric connection state is maintained stably without an overload being applied to connecting portions between the flexible cable and the first circuit board and between the flexible cable and the second circuit board.

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0014] FIG. **1** is a diagram of assistance in explaining main constituent parts of an electronic pen according to a first embodiment of the present disclosure;

[0015] FIGS. **2**A, **2**B, and **2**C are exploded views in which parts of the electronic pen according to the first embodiment of the present disclosure are arranged in an axial direction;

[0016] FIGS. **3**A and **3**B are longitudinal sectional views of a state in which a second casing is coupled to the rear end side of a first casing in the axial direction of the electronic pen according to the first embodiment of the present disclosure;

[0017] FIGS. **4**A, **4**B, and **4**C are diagrams of assistance in explaining an example of a configuration for protruding and retracting a pen tip portion of an electronic pen main body unit housed within the first casing, from an opening of the first casing, in the electronic pen according to the first embodiment of the present disclosure;

[0018] FIGS. **5**A, **5**B, **5**C, **5**D, and **5**E are diagrams of assistance in explaining an example of a

configuration for turning on a switch when the second casing is rotated with respect to the first casing in the electronic pen according to the first embodiment of the present disclosure;
[0019] FIG. **6** is a diagram of assistance in explaining the example of the configuration for turning on the switch when the second casing is rotated with respect to the first casing in the electronic pen according to the first embodiment of the present disclosure;
[0020] FIG. **7** is a diagram of assistance in explaining the example of the configuration for turning on the switch when the second casing is rotated with respect to the first casing in the electronic pen according to the first embodiment of the present disclosure;
[0021] FIG. **8** is a block diagram of assistance in explaining an example of an electronic circuit configuration of the electronic pen according to the first embodiment of the present disclosure;
[0022] FIG. **9** is a block diagram of assistance in explaining an example of an electronic circuit configuration of an electronic pen according to a second embodiment of the present disclosure;
[0023] FIG. **10** is a block diagram of assistance in explaining an example of an electronic circuit configuration of an electronic pen according to a third embodiment of the present disclosure; and
[0024] FIG. **11** is a diagram of assistance in explaining an example of a configuration of a coupling portion between a first casing and a second casing in the electronic pen according to a fourth embodiment of the present disclosure.

DETAILED DESCRIPTION

[0025] An electronic pen according to embodiments of the present disclosure will hereinafter be described with reference to the drawings. The electronic pen according to the embodiment to be described in the following represents an example of a case where the electronic pen has a configuration in which a pen tip portion of an electronic pen main body unit having a configuration of a cartridge is made to protrude and retract from an opening of an electronic pen casing by a rotation system (twist system).

Outline of Electronic Pen **1** According to Embodiment

[0026] FIG. **1** is a diagram of assistance in explaining main constituent parts of an electronic pen **1** according to an embodiment. The electronic pen **1** according to the present embodiment is constituted by a pen tip side module **2**, a rear end side module **3**, and a sliding member **4** as a follower that is slidingly moved in an axial direction by a rotating cam (twist cam) portion as a driver provided to the rear end side module **3** side, as will be described later.
[0027] The electronic pen **1** according to the present embodiment can be formed by coupling the rear end side module **3** to the rear end side of the pen tip side module **2** in the axial direction in a state in which the sliding member **4** is partially inserted in the pen tip side of the rear end side module **3**.
[0028] In an initial state (steady state) in which the rear end side module **3** is coupled to the rear end side of the pen tip side module **2** in the axial direction, a pen tip portion **5***a* of an electronic pen main body unit **5** within a casing **2**K of the pen tip side module **2** (which casing will be referred to as a pen tip side casing) is housed within the pen tip side casing **2**K without protruding from an opening **2**Kb on the pen tip side of the pen tip side casing **2**K. The pen tip portion **5***a* of the electronic pen main body unit **5** is thus protected.
[0029] Further, in the electronic pen **1** according to the present embodiment, when the rear end side module **3** is rotated with respect to the pen tip side module **2** in a predetermined rotational direction, or, for example, a clockwise direction, about the axial direction by a predetermined rotational angle, or 180 degrees in the present example, the pen tip portion **5***a* of the electronic pen main body unit **5** protrudes from the opening **2**Kb of the pen tip side casing **2**K, so that the electronic pen **1** is set in a usable state.
[0030] When the rear end side module **3** is rotated in a counterclockwise direction about the axial direction by 180 degrees from this usable state, the pen tip portion **5***a* of the electronic pen main body unit **5** is returned to the initial state in which the pen tip portion **5***a* is housed within the pen tip side casing **2**K without protruding from the opening **2**Kb of the pen tip side casing **2**K.

[0031] In addition, the electronic pen **1** according to the embodiment to be described in the following is configured to be able to switch an operation mode of the electronic pen **1** while the electronic pen **1** maintains the usable state in which the pen tip portion **5***a* of the electronic pen main body unit **5** is protruded from the opening **2**Kb of the pen tip side casing **2**K, when the electronic pen **1** is set in the usable state by rotating the rear end side module **3** by 180 degrees in the clockwise direction and, thereafter, the rear end side module **3** is further rotated in the clockwise direction about the axial direction by a predetermined rotational angle, or 60 degrees in the present example. In the embodiment to be described in the following, the mode switching is performed by a switch that is switching-controlled (turned on in the present example) as the rear end side module **3** is rotated in the axial direction.

[0032] Incidentally, the electronic pen **1** according to the embodiment to be described in the following represents a case of an electronic pen of an electromagnetic induction system. Moreover, in the present embodiment, as will be described later, the mode switching is performed by switching the resonance frequency of a resonance circuit of the electronic pen **1** of the electromagnetic induction system.

Configuration of Electronic Pen **1** According to Embodiment

[0033] A configuration and operation of the electronic pen **1** according to the embodiment that has functions as described above will be described with reference to FIGS. **2**A to **2**C and subsequent figures.

[0034] FIGS. **2**A to **2**C are exploded views in which parts of the electronic pen **1** according to the present embodiment are arranged in the axial direction. FIG. **2**A illustrates a part group housed within the pen tip side casing **2**K of the pen tip side module **2**. In addition, FIG. **2**B illustrates a part group housed within a casing **3**K of the rear end side module **3** (which casing will be referred to as a rear end side casing) except for the sliding member **4**. Further, FIG. **2**C illustrates the pen tip side casing **2**K of the pen tip side module **2**, the rear end side casing **3**K of the rear end side module **3**, parts **7** and **11** for coupling the pen tip side casing **2**K and the rear end side casing **3**K to each other, and a rear end side cap **18**.

[0035] In addition, FIGS. **3**A and **3**B are longitudinal sectional views of the electronic pen **1** in a state in which the rear end side module **3** is coupled to the rear end side of the pen tip side module **2** in the axial direction. FIG. **3**A is a longitudinal sectional view of the electronic pen **1** in the initial state. In addition, FIG. **3**B is a longitudinal sectional view of the electronic pen **1** in the usable state set by the rotation in the clockwise direction by 180 degrees from the initial state. Incidentally, though the electronic pen **1** according to the embodiment is, in practice, a thin electronic pen as illustrated in FIG. **1**, FIGS. **3**A and **3**B illustrate the electronic pen **1** with an increased diameter in order to facilitate the description of an internal configuration with reference to the longitudinal sectional views.

[0036] As illustrated in FIG. **2**C, the pen tip side casing **2**K of the pen tip side module **2** in the present example is formed in a cylindrical shape, and the opening **2**Kb is formed on the tapered pen tip side of the pen tip side casing **2**K. As illustrated in FIG. **1** and FIGS. **3**A and **3**B, housed within the pen tip side casing **2**K is the electronic pen main body unit **5** having a configuration of a cartridge. As illustrated in FIGS. **3**A and **3**B, provided within the electronic pen main body unit **5** is a circuit board (first circuit board) **50** having an electronic circuit formed thereon including a circuit for performing signal interaction with a position detecting sensor.

[0037] In the present example, the pen tip side casing **2**K is formed of resin, for example. As illustrated in FIG. **1** and FIGS. **3**A and **3**B, the inside diameter of the pen tip side casing **2**K is smaller on a pen tip side from approximately a middle in the axial direction than on a rear end side, and a step portion **2**Ka is formed at a position at which the inside diameter changes. Specifically, as illustrated in FIG. **1**, the inside diameter on the pen tip side from approximately the middle in the axial direction of the pen tip side casing **2**K is set at R1, and the inside diameter on the rear end side is set at R2 (>R1), which is larger than the inside diameter R1 on the pen tip side.

[0038] Meanwhile, a casing **5**K of the electronic pen main body unit **5** (which casing will be referred to as a main body unit casing) is formed of resin, for example, and as illustrated in FIG. **1** and FIG. **2**A, a part on the rear end side of the main body unit casing **5**K has a larger outside diameter than another part, with a step portion **5**Ka formed at a position at which the outside diameter changes. In this case, as illustrated in FIG. **1**, a maximum value R3 of the outside diameter on the pen tip side of the main body unit casing **5**K of the electronic pen main body unit **5** is set at a value smaller than the inside diameter R1 on the pen tip side of the pen tip side casing **2**K (R3<R1), and an outside diameter R4 on the rear end side of the main body unit casing **5**K of the electronic pen main body unit **5** is set at a value larger than the inside diameter R1 on the pen tip side of the pen tip side casing **2**K but smaller than the inside diameter R2 on the rear end side of the pen tip side casing **2**K (R1<R4<R2).

[0039] In addition, the inside diameter of the opening **2**Kb on the pen tip side of the pen tip side casing **2**K of the pen tip side module **2** is set to be larger than a maximum value of the outside diameter of the pen tip portion **5***a* of the electronic pen main body unit **5**. The pen tip portion **5***a* of the electronic pen main body unit **5** is thus configured to be able to protrude from the opening **2**Kb on the pen tip side of the pen tip side casing **2**K.

[0040] Moreover, as illustrated in FIG. **1**, in the pen tip side casing **2**K of the pen tip side module **2**, a coil spring **6** whose winding diameter R5 is set such that R3<R5<R2 is provided to be present between the step portion **2**Ka of the pen tip side casing **2**K and the step portion **5**Ka of the main body unit casing **5**K of the electronic pen main body unit **5** in a state in which the coil spring **6** is wound around a part of the outside diameter R3 of the electronic pen main body unit **5**.

[0041] Specifically, the coil spring **6** is inserted into the pen tip side casing **2**K from an opening on the rear end side of the pen tip side casing **2**K. Then, one end in the axial direction of the coil spring **6** abuts against the step portion **2**Ka of the pen tip side casing **2**K, and the coil spring **6** is locked at that position within the pen tip side casing **2**K. When the electronic pen main body unit **5** is thereafter inserted from the opening on the rear end side of the pen tip side casing **2**K with the pen tip portion **5***a* side of the electronic pen main body unit **5** in front, a small-diameter portion of the outside diameter R3 of the electronic pen main body unit **5** penetrates the coil spring **6**, and enters the pen tip side of the pen tip side casing **2**K. Then, the electronic pen main body unit **5** is locked within the pen tip side casing **2**K when another end in the axial direction of the coil spring **6** abuts against the step portion **5**Ka of the electronic pen main body unit **5**. At this time, the coil spring **6** constantly acts within the pen tip side casing **2**K in such a manner as to elastically bias the electronic pen main body unit **5** to the rear end side in the axial direction.

[0042] In this case, in the initial state (steady state), as illustrated in FIG. **1**, the pen tip portion **5***a* of the electronic pen main body unit **5** is housed and protected within the pen tip side casing **2**K without protruding from the opening **2**Kb of the pen tip side casing **2**K, by selecting the formation position of the step portion **2**Ka in the pen tip side casing **2**K, the formation position of the step portion **5**Ka of the main body unit casing **5**K of the electronic pen main body unit **5**, and the length of the coil spring **6**. Then, as will be described later, when the rear end side module **3** is rotated by 180 degrees, the electronic pen main body unit **5** is pushed to the pen tip side against an elastic biasing force of the coil spring **6**. The usable state in which the pen tip portion **5***a* of the electronic pen main body unit **5** protrudes from the opening **2**Kb of the pen tip side casing **2**K is thereby set.

[0043] As illustrated in FIG. **1** and FIGS. **3**A and **3**B, a coupling member **7** for coupling to the rear end side module **3** is provided by being, for example, press-fitted to the rear end side of the pen tip side casing **2**K of the pen tip side module **2**. The coupling member **7** is formed of resin, for example, and is constituted by a hollow tubular body, as illustrated in FIG. **2**C. Further, as illustrated in FIGS. **3**A and **3**B, the sliding member **4** is configured such that the sliding member **4** is movable in the axial direction within a hollow portion of the coupling member **7** and such that an end portion on the pen tip side in the axial direction of the sliding member **4** is able to abut against an end portion on the rear end side of the electronic pen main body unit **5**.

[0044] As illustrated in FIG. **1** and FIGS. **3**A and **3**B, the coupling member **7** is attached to the rear end side of the pen tip side casing **2**K in a state in which approximately half of the tubular body of the coupling member **7** protrudes from the rear end side of the pen tip side casing **2**K of the pen tip side module **2**. Moreover, as illustrated in FIG. **1** and FIG. **2**C, a recessed portion **7***a* is formed in the protruding part of the coupling member **7**, the recessed portion **7***a* being formed by making an outside diameter thereof slightly smaller than those of other parts in the axial direction. Moreover, as illustrated in FIG. **1** and FIG. **2**C, a rear end side end portion of the coupling member **7** is provided with a tapered portion **7***b* that has a larger outside diameter than the recessed portion **7***a* but is tapered in such a manner as to have an outside diameter thereof reduced toward a distal end side of the rear end side end portion.

[0045] Further, as illustrated in FIG. **1** and FIG. **2**C, a groove portion **7***c* extending from the tapered portion **7***b* to the recessed portion **7***a* in a direction along the axial direction is formed in the coupling member **7**. The presence of the groove portion **7***c* enables the tapered portion **7***b* of the coupling member **7** to be elastically contracted in a direction of a center line of the tubular coupling member **7**.

[0046] Meanwhile, as illustrated in FIG. **1** and FIGS. **3**A and **3**B, a tubular member **11** configured to be fitted to the recessed portion **7***a* of the coupling member **7** attached to the pen tip side module **2** is attached by being, for example, press-fitted and fixed to an opening **3**Ka (see FIG. **2**C) on the pen tip side of the rear end side casing **3**K of the rear end side module **3**. As illustrated in FIG. **2**C, the length in the axial direction of the tubular member **11** is selected to be substantially equal to or slightly smaller than the length in the axial direction of the recessed portion **7***a*. In addition, the inside diameter of the tubular member **11** is selected to be slightly larger than the outside diameter of the recessed portion **7***a* of the coupling member **7**, and is thus configured to allow the rear end side module **3** to be rotated about the axial direction with respect to the pen tip side of the pen tip side module **2** when the rear end side module **3** is coupled to the pen tip side module **2**.

[0047] As illustrated in FIG. **2**B and FIGS. **3**A and **3**B, a rear end side inner casing **12** constituted by a tubular body is housed within the rear end side casing **3**K of the rear end side module **3**. It is to be noted that, as illustrated in FIG. **2**B and FIGS. **3**A and **3**B, the rear end side inner casing **12** includes a front end side portion **12***a* that has a smaller outside diameter than the inside diameter of the coupling member **7** and that constitutes a pen tip side in the axial direction and a rear end side portion **12***b* more to the rear end side than the front end side portion **12***a*, and a part of the pen tip side of the front end side portion **12***a* is configured to protrude to the pen tip side module **2** side from the opening **3**Ka on the pen tip side of the rear end side casing **3**K.

[0048] As illustrated in FIGS. **3**A and **3**B, the rear end side portion **12***b* of the rear end side inner casing **12** is covered with a tubular rear end portion cover **13** (see FIG. **2**B), and a circuit board (second circuit board) **100** (see FIG. **2**B and FIGS. **3**A and **3**B) is provided within the rear end side portion **12***b*. Moreover, in the present embodiment, the electronic circuit on the circuit board **50** provided to the pen tip side module **2** and an electronic circuit on the circuit board **100** provided to the rear end side module **3** are electrically connected to each other.

Electric Connection Between Circuit Board **50** and Circuit Board **100**

[0049] In the electronic pen **1** according to the present embodiment, as illustrated in FIG. **1**, FIG. **2**A, and FIGS. **3**A and **3**B, a flexible cable (flexible flat cable) **8** in which a conductive pattern electrically connected to the circuit board **50** is formed is drawn out from a rear end portion of the electronic pen main body unit **5** housed in the pen tip side module **2** in order to electrically connect the circuit board **50** and the circuit board **100** to each other.

[0050] As illustrated in FIGS. **3**A and **3**B, the flexible cable **8** is extended to the rear end side module **3** through a space in the sliding member **4** located within the hollow portion of the coupling member **7** and a hollow portion of the front end side portion **12***a* of the rear end side inner casing **12**. Further, the conductive pattern of the flexible cable **8** is electrically connected to the circuit board **100** housed within the rear end side inner casing **12**.

[0051] In this case, the flexible cable **8** in the present example is a flexible cable in a thin sheet shape, that is, a flexible flat cable, that has such a narrow width as to be extended to the rear end side module **3** through the space in the sliding member **4** located within the hollow portion of the coupling member **7** and the hollow portion of the front end side portion **12***a* of the rear end side inner casing **12**. Moreover, in consideration of the configuration in which the rear end side module **3** is rotated about the axial direction with respect to the pen tip side module **2**, the flexible cable **8** in the present example is provided with a surplus portion **8***a* as illustrated in FIG. **2**A and FIGS. **3**A and **3**B, in order to prevent the occurrence of such an effect as the occurrence of a defect in a state of electric connection between the circuit board **50** and the circuit board **100** by the flexible cable **8** due to the rotation of the rear end side module **3**.

[0052] In the present embodiment, as illustrated in FIG. **2**A and FIG. **3**A, the surplus portion **8***a* is formed by curving (or bending) the flexible cable **8** extending in the axial direction of the electronic pen **1** into a U-shape in such a manner as to fold back the flexible cable **8** in a direction opposite to the extending direction, and further curving (or bending) the curved (or bent) part whose longitudinal direction is set in the opposite direction, in such a manner as to fold back the part in the same direction as the extending direction. That is, the surplus portion **8***a* is formed in such a manner as to have overlaps in a direction orthogonal to a flat surface of the flexible cable **8**.

[0053] A total length in the longitudinal direction of the surplus portion **8***a* of the flexible cable **8** is set in consideration of an amount of length displacement corresponding to the rotational angle of the rear end side module **3** with respect to the pen tip side module **2**, or a rotational angle of 180 degrees+60 degrees=240 degrees in the present example, and an amount of length displacement corresponding to an amount of twisting of the flexible cable **8** (see FIG. **3**B), and also in consideration of an amount of length displacement corresponding to a movement distance in the axial direction of the electronic pen main body unit **5** because, in the present embodiment, the electronic pen main body unit **5** can be protruded and retracted from the opening **2**Kb of the pen tip side casing **2**K as the rear end side module **3** is rotated. Incidentally, it is needless to say that it suffices to consider only the amounts of length displacement corresponding to the rotational angle of the rear end side module **3** and the twisting of the flexible cable **8** (see FIG. **3**B) in a case of a configuration in which the electronic pen main body unit **5** does not move in the axial direction even when the rear end side module **3** is rotated.

[0054] Needless to say, in a case where the circuit board **50** and the circuit board **100** are arranged at positions including the central position of circular cross sections of hollow portions of the pen tip side casing **2**K and the rear end side casing **3**K and the central position in the width direction of the flexible cable **8** is configured to coincide with the center line position of the pen tip side casing **2**K and the rear end side casing **3**K, it suffices to consider only the amount of displacement due to the amount of twisting caused by the rotation for the surplus portion **8***a* of the flexible cable **8**. However, in a case where the circuit board **50** and the circuit board **100** are located at eccentric positions shifted from the center in the circular cross sections of the hollow portions of the pen tip side casing **2**K and the rear end side module **3**, the amount of length displacement corresponding to the rotational angle is taken into consideration, as described above.

[0055] Incidentally, in the present embodiment, the flexible cable **8** is formed by a shape-memory resin sheet, and is formed such that the surplus portion **8***a* has the folded shape as described above. Therefore, when the rear end side module **3** is rotated from the initial state (steady state) and set in a usage state, the surplus portion **8***a* of the flexible cable **8** is set in a twisted state and in a state of being extended in the axial direction (longitudinal direction) as illustrated in FIG. **3**B, whereas, when the rear end side module **3** is returned to the original initial state after being reversely rotated, the surplus portion **8***a* automatically returns to the shape-memorized state as illustrated in FIG. **3**A.

[0056] As is understood from the above, the surplus portion **8***a* of the flexible cable **8** plays a role of accommodating an amount of movement in the axial direction of the electronic pen main body unit **5** when the electronic pen main body unit **5** housed within the pen tip side casing **2**K of the pen

tip side module **2** is moved in the axial direction by the rotation of the rear end side module **3**, and the surplus portion **8***a* plays a role of accommodating also an amount of twist displacement of the flexible cable **8** due to the rotation of the rear end side module **3**.

[0057] Hence, according to the electronic pen **1** according to the present embodiment, the occurrence of such an effect as the occurrence of a defect in the state of electric connection between the circuit board **50** and the circuit board **100** by the flexible cable **8** can be prevented even when the pen tip side module **2** and the rear end side module **3** are respectively provided with the circuit board **50** and the circuit board **100**, the circuit board **50** and the circuit board **100** are electrically connected to each other, and the electronic pen main body unit **5** is configured to be protruded and retracted from the opening **2**Kb of the pen tip side casing **2**K of the pen tip side module **2** by rotating the rear end side module **3** with respect to the pen tip side module **2**.

Example of Configuration of Sliding Member **4** and Rotating Cam Portion

[0058] In the present embodiment, the front end side portion **12***a* of the rear end side inner casing **12** of the rear end side module **3** has functions of a rotating cam for slidingly moving the sliding member **4** in the axial direction when the rear end side module **3** is rotated about the axial direction with respect to the pen tip side module **2**.

[0059] Specifically, in the present embodiment, the front end side portion **12***a* of the rear end side inner casing **12** includes a part protruding from the opening **3**Ka of the pen tip side of the rear end side casing **3**K to the pen tip side, and a rotating cam portion **14** that engages with the sliding member **4** and slidingly moves the sliding member **4** is formed at a distal end portion of the part protruding to the pen tip side in the front end side portion **12***a*, as illustrated in FIG. **1**, FIG. **2**B, and FIGS. **3**A and **3**B.

[0060] FIG. **4**A is an enlarged view of the rear end side inner casing **12** illustrated in FIG. **2**B. FIG. **4**B is a view illustrating an example of a configuration of the rotating cam portion **14** formed at the front end side portion **12***a* of the rear end side inner casing **12**. In addition, FIG. **4**C is a view illustrating an example of a state of engagement between the rotating cam portion **14** formed at the front end side portion **12***a* of the rear end side inner casing **12** and the sliding member **4**.

[0061] As illustrated in FIG. **4**A and FIG. **4**B, the rotating cam portion **14** formed at the front end side portion **12***a* of the rear end side inner casing **12** includes an inclined end surface portion **14***a* having a shape obtained by obliquely cutting a front end portion of the front end side portion **12***a* by an angle of 180 degrees, a first flat end surface portion **14***b* formed in such a manner as to be flat by an amount of a predetermined angle in a direction orthogonal to the axial direction from a front end side of the inclined end surface portion **14***a*, a protruding portion **14***c* formed by an amount of a predetermined angle from the first flat end surface portion **14***b* in such a manner as to protrude in the axial direction more than the first flat end surface portion **14***b*, a second flat end surface portion **14***d* formed in a manner similar to that of the first flat end surface portion **14***b* by an amount of a predetermined angle next to the protruding portion **14***c* in such a manner as to be recessed in the axial direction from the protruding portion **14***c*, and a protruding part **14***c* that greatly protrudes in the axial direction by an amount of a predetermined angle next to the second flat end surface portion **14***d*.

[0062] A length in the axial direction of the inclined end surface portion **14***a* of the rotating cam portion **14** is selected to be equal to a movement length of the electronic pen main body unit **5** in the axial direction for shifting the pen tip portion **5***a* of the electronic pen main body unit **5** from a state in which the pen tip portion **5***a* of the electronic pen main body unit **5** is protected as illustrated in FIG. **3**A to a state in which the pen tip portion **5***a* of the electronic pen main body unit **5** is protruded from the opening **2**Kb of the pen tip side casing **2**K as illustrated in FIG. **3**B. Moreover, lengths (angles) in a circumferential direction of the first flat end surface portion **14***b* and the second flat end surface portion **14***d* are set to be sufficient lengths (angular amounts) for a rear end side end surface **4***be* of a protruding portion **4***b* of the sliding member **4** to be engaged with and locked to the first flat end surface portion **14***b* and the second flat end surface portion **14***d*.

[0063] FIG. **4**C illustrates a state in which the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** engages with the second flat end surface portion **14***d* of the rotating cam portion **14** when the rear end side module **3** is rotated by 240 degrees from the initial state with respect to the pen tip side module **2**.
[0064] Incidentally, the height of the protruding portion **14***c* of the rotating cam portion **14** is selected to be such a height that the protruding portion **14***c* cannot be gone over when a user rotates the rear end side module **3** with a small force but the protruding portion **14***c* can be gone over by application of a predetermined or stronger force. In addition, the protruding part **14***e* of the rotating cam portion **14** is configured such that the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** cannot go over the protruding part **14***e* even when the user rotates the rear end side module **3**.
[0065] As illustrated in FIG. **1**, FIG. **2**B, and FIG. **4**B, the sliding member **4** includes a sliding member main body portion **4***a* having a configuration corresponding to substantially half the circumference of a tubular body and the protruding portion **4***b*. The protruding portion **4***b* is formed at an edge portion of the side circumferential surface of the tubular body corresponding to substantially half the circumference in the sliding member main body portion **4***a* in such a manner as to extend from an end portion of the pen tip side of the sliding member **4** in the axial direction to a position approximately in a middle in the axial direction and protrude in a direction orthogonal to the axial direction. Moreover, the outside diameter of the sliding member main body portion **4***a* of the sliding member **4** is set to be slightly smaller than the inside diameter of the front end side portion **12***a* of the rear end side inner casing **12**, and the height in the direction orthogonal to the axial direction of the protruding portion **4***b* is set to be such a height that the protruding portion **4***b* engages with the rotating cam portion **14** at an end surface of the front end side portion **12***a* of the rear end side inner casing **12** and slightly protrudes from the peripheral side surface of the front end side portion **12***a* of the rear end side inner casing **12**.
[0066] Hence, as illustrated in FIGS. **4**B and **4**C, the rear end side end surface **4***be* of the sliding member **4** engages with the rotating cam portion **14** formed at a front end of the front end side portion **12***a* of the rear end side inner casing **12** in a state in which a rear end side part of the sliding member main body portion **4***a* on which part the protruding portion **4***b* is not present in the axial direction enters the inside of the front end side portion **12***a* of the rear end side inner casing **12** and the protruding portion **4***b* slightly protrudes from the peripheral side surface of the front end side portion **12***a* of the rear end side inner casing **12**. Moreover, as described earlier, in a state in which the pen tip side module **2** and the rear end side module **3** are coupled to each other, an end portion on the pen tip side of the sliding member **4** abuts against the rear end portion of the electronic pen main body unit **5**.
[0067] As illustrated in FIGS. **3**A and **3**B, in a state in which the pen tip side module **2** and the rear end side module **3** are coupled to each other, the electronic pen main body unit **5** is elastically biased to the rear end side by the coil spring **6** at all times. Thus, in the initial state of FIG. **3**A, the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** engages with a part **14***as* on a rearmost end side of the inclined end surface portion **14***a* of the rotating cam portion **14**.
[0068] When the rear end side inner casing **12** is then rotated in the clockwise direction as indicated by an arrow AR**1** in FIG. **4**B by rotating the rear end side module **3** from the initial state in the clockwise direction about the axial direction with respect to the pen tip side module **2**, the sliding member **4** engaging with the rotating cam portion **14** at the part **14***as* is slidingly moved by the inclined end surface portion **14***a* of the rotating cam portion **14** in such a manner as to be pushed out in the axial direction indicated by an arrow AR**2**, within the hollow portion of the coupling member **7**.
[0069] In this case, a recessed groove **7***d* (see FIG. **2**C) in the axial direction is provided to the inner wall surface of the hollow portion of the coupling member **7**, the recessed groove **7***d* housing

a part of the protruding portion **4***b* of the sliding member **4** which part slightly protrudes from the peripheral surface of the front end side portion **12***a* of the rear end side inner casing **12** and guiding movement in the axial direction of the sliding member **4**. Hence, the sliding member **4** is slidingly moved while maintaining a predetermined angular position without being rotated in the hollow portion of the coupling member **7** of the pen tip side module **2**.

[0070] When the rear end side inner casing **12** is then rotated by 180 degrees from the initial state, the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** transfers from the inclined end surface portion **14***a* to the first flat end surface portion **14***b* of the rotating cam portion **14**, and the sliding member **4** is locked. At this time, the electronic pen **1** is in the usable state in which the pen tip portion **5***a* of the electronic pen main body unit **5** protrudes from the opening **2**Kb of the pen tip side casing **2**K. Incidentally, in this case, as illustrated in FIG. **3**B, not only a front end portion **53***a* of a core body **53** as the pen tip portion **5***a* of the electronic pen main body unit **5** but also the pen tip side of a ferrite core **52** protrudes from the opening **2**Kb.

[0071] The user perceives the transfer of the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** from the inclined end surface portion **14***a* to the first flat end surface portion **14***b* of the rotating cam portion **14** as a locking in a clicking manner, which indicates completion of the rotation of 180 degrees from the initial state and a transition from the initial state to the usable state.

[0072] Next, in this usable state, when the user further rotates the rear end side module **3** in the clockwise direction with respect to the pen tip side module **2** such that the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** goes over the protruding portion **14***c*, the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** engages with the second flat end surface portion **14***d* of the rotating cam portion **14**, and the sliding member **4** is locked (see FIG. **4**C). In a rotating operation at this time, the user perceives, as a locking in a clicking manner, a transition in which the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** goes over the protruding portion **14***c* of the rotating cam portion **14** and engages with the second flat end surface portion **14***d*.

[0073] As described earlier, the rear end side end surface **4***be* of the protruding portion **4***b* of the sliding member **4** engages with the second flat end surface portion **14***d* when the rear end side module **3** is rotated from the initial state by a rotational angle of 240 degrees in the clockwise direction with respect to the pen tip side module **2**. In the present embodiment, as described earlier, an operation of effecting the rotation by 60 degrees (=240 degrees-180 degrees) from the usable state is configured to be a mode switching operation.

Example of Configuration of Mode Switching Switch

[0074] A constituent part for this mode switching will next be described. In the present embodiment, the mode switching is configured to be based on the turning on and off of a mode switching switch. Specifically, as illustrated in FIG. **2**B and FIG. **4**A, the mode switching switch **15** is provided to the rear end side portion **12***b* of the rear end side inner casing **12** that is rotated with the rotation of the rear end side module **3**.

[0075] As illustrated in FIG. **2**B and FIG. **4**A, the mode switching switch **15** is constituted by a first electrode piece **151** and a second electrode piece **152** formed by two conductive members, or two metallic pieces in the present example, which are provided in a state of being insulated from each other. The first electrode piece **151** has a configuration provided with a fixed contact. The second electrode piece **152** has a configuration provided with a movable contact that turns on the switch by being electrically connected to the fixed contact of the first electrode piece **151** by the rotation of the above-described rear end side module **3** by 60 degrees, as will be described in the following.

[0076] As illustrated in FIG. **4**A, the first electrode piece **151** is formed by bending a conductive metallic sheet in a hook shape, and one end portion **151***a* of the first electrode piece **151** that has been bent is electrically connected to the circuit board **100** provided within the rear end side portion **12***b*, through a through hole **12***c* formed in the rear end side portion **12***b* of the rear end side inner

casing **12**. Moreover, a distal end of another end portion of the first electrode piece **151** is further bent in a hook shape. A fixed contact **151***b* is formed on the distal end portion.

[0077] Meanwhile, the second electrode piece **152** is also similarly formed by bending a conductive metallic sheet into a hook shape, and one end portion **152***a* of the second electrode piece **152** that has been bent is electrically connected to the circuit board **100** provided within the rear end side portion **12***b*, through the through hole **12***c* formed in the rear end side portion **12***b* of the rear end side inner casing **12**. Moreover, a distal end portion of another end portion of the second electrode piece **152** is bent in such manner as to be opposed at a predetermined distance to the fixed contact **151***b* on the other end portion of the first electrode piece **151**, and is formed in an elastically displaceable shape such that the distal end portion of the second electrode piece **152** can come into contact with the fixed contact **151***b* by being elastically displaced by an external pressing force. Moreover, a movable contact **152***b* is provided to a part of the second electrode piece **152** which part is opposed to the fixed contact **151***b* and has the elastically displaceable shape.

[0078] In this case, the mode switching switch **15** constituted by the first electrode piece **151** and the second electrode piece **152** is disposed at a predetermined position of the rear end side portion **12***b* of the rear end side inner casing **12** formed integrally with a front end side portion **12***a* at which the rotating cam portion **14** is formed. Thus, the mode switching switch **15** is in a fixed positional relation to the rotating cam portion **14** with regard to rotational directions about the axial direction.

[0079] Moreover, in the present embodiment, as illustrated in FIG. **1** and FIG. **2**C, a predetermined angular position of an end portion of a part of the coupling member **7** which part protrudes from the rear end side of the pen tip side casing **2**K is provided with a pressing cam piece **7***e* that further protrudes in the axial direction from the end portion. The pressing cam piece **7***e* is provided at such an angular position as to be able to drive the elastically displaceable movable contact **152***b* of the second electrode piece **152** of the mode switching switch **15** by a distal end portion in the axial direction of the pressing cam piece **7***e* and thereby bring the fixed contact **151***b* of the first electrode piece **151** and the movable contact **152***b* of the second electrode piece **152** into electric contact with each other.

[0080] That is, in the present embodiment, the protruding portion **4***b* of the sliding member **4** is configured to be slid while guided by the recessed groove **7***d* of the coupling member **7**. Hence, the angular position in the circumferential direction of the protruding portion **4***b* of the sliding member **4** is fixed to be constant according to the position of the recessed groove **7***d* of the coupling member **7**. Moreover, as described earlier, the protruding portion **4***b* of the sliding member **4** and the rotating cam portion **14** engage with each other. Thus, the angular position in the circumferential direction of each part of the rotating cam portion **14** is configured to be determined by the position of the protruding portion **4***b* of the sliding member **4**.

[0081] From the above, the positional relation in the circumferential direction (rotational direction) in the initial state at a time at which the rear end side module **3** is coupled to the pen tip side module **2** is determined with the circumferential position of the recessed groove **7***d* within the hollow portion of the coupling member **7** as a reference. Accordingly, the angular position in the circumferential direction of the pressing cam piece **7***e* formed on the coupling member **7** is determined with the circumferential position of the recessed groove **7***d* of the coupling member **7** as a reference.

[0082] In this case, the pressing cam piece **7***e* formed on the coupling member **7** is set in such a circumferential position (rotational direction angular position) as to elastically press the movable contact **152***b* of the second electrode piece **152** of the mode switching switch **15** and thereby bring the movable contact **152***b* into electric contact with the fixed contact **151***b* of the first electrode piece **151** when the rear end side module **3** is rotated by 240 degrees with respect to the pen tip side module **2** from the initial state at the time at which the rear end side module **3** is coupled to the pen tip side module **2**.

[0083] Incidentally, the size of the pressing cam piece **7***e* is set to be such a size that the pressing cam piece **7***e* is able to drive the elastically displaceable movable contact **152***b* of the second electrode piece **152** of the mode switching switch **15** by the distal end portion in the axial direction of the pressing cam piece **7***e* and thereby bring the fixed contact **151***b* of the first electrode piece **151** and the movable contact **152***b* of the second electrode piece **152** into electric contact with each other.

[0084] FIGS. **5**A to **5**E, FIG. **6**, and FIG. **7** are views of assistance in explaining a manner in which, as a result of the rotation of the rear end side inner casing **12** with the rotation of the rear end side module **3**, the pressing cam piece **7***e* of the coupling member **7** turns on the mode switching switch **15** provided to the rear end side inner casing **12**.

[0085] FIG. **5**A is a view illustrating the positional relation between the rear end side inner casing **12** and the coupling member **7** at a time at which the electronic pen **1** is in the initial state (see FIG. **3**A). Because the mode switching switch **15** and the pressing cam piece **7***e* of the coupling member **7** are displaced from each other by an amount of a rotational angle of 260 degrees, the pressing cam piece **7***e* does not appear in this figure. At this time, the rotating cam portion **14** of the front end side portion **12***a* of the rear end side inner casing **12** is present within the coupling member **7**, and the sliding member **4** is positioned on the rearmost end side in the electronic pen **1**.

[0086] When the user rotates the rear end side module **3** in the clockwise direction by 180 degrees from the initial state, the positional relation between the rear end side inner casing **12** and the coupling member **7** becomes a positional relation as illustrated in FIG. **5**B and FIG. **5**C. That is, FIG. **5**B illustrates a state in which the rear end side inner casing **12** is rotated by 180 degrees from the initial state of FIG. **5**A. In addition, FIG. **5**C is a view of the state at this time as viewed from an angle side different by 180 degrees where the switch **15** is disposed.

[0087] As illustrated in FIGS. **5**B and **5**C, at this time, the sliding member **4** is moved in the axial direction by engagement thereof with the rotating cam portion **14** at the front end of the front end side portion **12***a* of the rear end side inner casing **12** to move the electronic pen main body unit **5** in a pen tip direction within the pen tip side casing **2**K, and the electronic pen **1** is set in the usable state (see FIG. **3**B) in which the pen tip portion **5***a* of the electronic pen main body unit **5** protrudes from the opening **2**Kb of the pen tip side casing **2**K.

[0088] Moreover, in this usable state, as illustrated in FIG. **5**C, the pressing cam piece **7***e* of the coupling member **7** is not at a position of engaging with the mode switching switch **15**, and the mode switching switch **15** remains off. FIG. **6** is an enlarged view of assistance in explaining the positional relation between the mode switching switch **15** and the pressing cam piece **7***e* of the coupling member **7** at this time. It is to be noted that, in FIG. **6**, the positional relation in the axial direction between the front end side portion **12***a* of the rear end side inner casing **12** and the coupling member **7** is horizontally opposite to that of FIG. **5**C.

[0089] As illustrated in FIG. **6**, in the usable state of the electronic pen **1**, the pressing cam piece **7***e* of the coupling member **7** and the mode switching switch **15** are separated from each other by an angle of 60 degrees. Therefore, the movable contact **152***b* of the second electrode piece **152** of the mode switching switch **15** is not in contact with the fixed contact **151***b* of the first electrode piece **151**, and the mode switching switch **15** remains off.

[0090] When the user further rotates the rear end side module **3** in the clockwise direction by 60 degrees from the usable state, the positional relation between the rear end side inner casing **12** and the coupling member **7** becomes a positional relation as illustrated in FIG. **5**D and FIG. **5**E. That is, FIG. **5**D illustrates a state in which the rear end side inner casing **12** is rotated by 60 degrees from the usable state of FIG. **5**C. In addition, FIG. **5**E is a view of the state at this time as viewed from the angle side different by 180 degrees where the mode switching switch **15** is disposed.

[0091] As illustrated in FIGS. **5**D and **5**E, at this time, due to the engagement with the rotating cam portion **14** at the front end of the front end side portion **12***a* of the rear end side inner casing **12**, the sliding member **4** is not moved in the axial direction except when the sliding member **4** goes over

the protruding portion **14***c* of the rotating cam portion **14**, and the electronic pen **1** maintains the usable state (see FIG. **3**B) in which the pen tip portion **5***a* of the electronic pen main body unit **5** protrudes from the opening **2**Kb of the pen tip side casing **2**K.

[0092] Moreover, in this state, as illustrated in FIG. **5**E, the pressing cam piece **7***e* of the coupling member **7** is at a position of engaging with the mode switching switch **15**, and the mode switching switch **15** is on. FIG. **7** is an enlarged view of assistance in explaining the positional relation between the mode switching switch **15** and the pressing cam piece **7***e* of the coupling member **7** at this time. It is to be noted that, in FIG. **7**, the positional relation in the axial direction between the front end side portion **12***a* of the rear end side inner casing **12** and the coupling member **7** is horizontally opposite to that of FIG. **5**E.

[0093] As illustrated in FIG. **7**, in a state in which the rear end side module **3** is rotated by 240 degrees from the initial state of the electronic pen **1**, the pressing cam piece **7***e* of the coupling member **7** engages with the second electrode piece **152** of the mode switching switch **15**, and elastically presses the movable contact **152***b* of the second electrode piece **152**. Therefore, as illustrated in FIG. **7**, the movable contact **152***b* of the second electrode piece **152** of the mode switching switch **15** is in contact with the fixed contact **151***b* of the first electrode piece **151**, and the mode switching switch **15** is on. In the present embodiment, as will be described later, the switching of the mode switching switch **15** to an on state is assumed to be the switching of the operation mode of the electronic pen **1**.

[0094] Incidentally, when the rear end side module **3** is rotated in the counterclockwise direction by 60 degrees with respect to the pen tip side module **2** from the state illustrated FIGS. **5**D and **5**E, the engagement between the pressing cam piece **7***e* of the coupling member **7** and the second electrode piece **152** of the mode switching switch **15** is released. Thus, the mode switching switch **15** is returned to an off state, and the operation mode is returned to an original state. At this time, the electronic pen **1** is in the usable state illustrated in FIGS. **5**B and **5**C.

[0095] When the rear end side module **3** is then rotated in the counterclockwise direction by 180 degrees with respect to the pen tip side module **2** from the usable state of the electronic pen **1**, the electronic pen **1** is returned to the initial state illustrated in FIG. **5**A and FIG. **3**A.

Example of Configuration of Electric Parts of Electronic Pen **1**

[0096] A configuration of electric parts of the electronic pen **1** according to the present embodiment will next be described. Description will first be made of electric parts arranged on the circuit board **50** provided within the electronic pen main body unit **5**.

[0097] As described above, the circuit board **50** disposed within the electronic pen main body unit **5** is provided with an electronic circuit including a circuit for performing signal interaction with the position detecting sensor. The electronic pen **1** according to the present embodiment is an electronic pen of an electromagnetic induction system. As illustrated in FIGS. **3**A and **3**B, a ferrite core **52** as an example of a magnetic core wound with a coil **51** is disposed on the pen tip side within the main body unit casing **5**K of the electronic pen main body unit **5**.

[0098] The circuit board **50** is provided with a capacitor **54** (see FIGS. **3**A and **3**B) that forms a resonance circuit together with the coil **51**. Both terminals of the coil **51** are connected to a conductive pattern of the circuit board **50** to which both terminals of the capacitor **54** are connected.

[0099] As illustrated in FIGS. **3**A and **3**B, a through hole is provided in the ferrite core **52**, and the core body **53** formed of resin, for example, is provided in such a manner as to be movable in the axial direction through the through hole. The front end portion **53***a* of the core body **53** protrudes to the outside from an opening on the pen tip side of the main body unit casing **5**K. Moreover, the rear end side of the core body **53** is fitted into a fitting portion **55***a* of a pen pressure detecting unit **55** provided on the rear end side of the ferrite core **52**.

[0100] The pen pressure detecting unit **55** is constituted by a well-known pen pressure detecting unit that detects, as a change in capacitance in the present example, a displacement in the axial

direction of the core body **53** which displacement corresponds to a pen pressure applied to the front end portion **53***a* of the core body **53**. A specific configuration of the pen pressure detecting unit **55** in the present example is well known, and is therefore not illustrated in the figures. However, the pen pressure detecting unit **55** is constituted by a variable capacitance capacitor whose capacitance is changed by a change in an area of contact between a dielectric and a conductive elastic member according to an applied pressure (see, for example, Japanese Patent Laid-Open No. 2016-126503 and the like). Incidentally, the pen pressure detecting unit **55** that detects the pen pressure on the basis of the capacitance may be constituted by a pen pressure detecting unit formed by a semiconductor device in which a distance between two electrodes opposed to each other with an air layer as a dielectric interposed therebetween changes according to the applied pressure (see, for example, Japanese Patent Laid-Open No. 2013-161307 and the like).

[0101] A first electrode and a second electrode of the variable capacitance capacitor formed in the pen pressure detecting unit **55** are connected to the conductive pattern of the circuit board **50**.

[0102] Moreover, in the present example, on the circuit board **50**, two side switches **56**A and **56**B are provided in such a manner as to be aligned with each other in the axial direction. As is well known, operations of turning on and off the side switches **56**A and **56**B are set in such a manner as to be associated with, for example, a predetermined function such as a function corresponding to a mouse pointer clicking operation in an electronic apparatus including the position detecting sensor that performs signal interaction with the electronic pen **1**.

[0103] The side switches **56**A and **56**B in the present example are push-button switches. Though not illustrated in the figures, the side switches **56**A and **56**B are constituted by switches that alternately repeat on and off each time depression operating elements thereof that protrude upward when the switches are arranged on the circuit board **50** are depressed. The depression operating elements of the side switches **56**A and **56**B automatically and elastically restore themselves when a depression force disappears.

[0104] In the axial direction of the main body unit casing **5**K of the electronic pen main body unit **5**, a rectangular through hole **5**Kb (see FIG. **2**A) through which the side switches **56**A and **56**B can be seen from the outside is formed at a position above a position at which the side switches **56**A and **56**B are arranged. Moreover, within the rectangular through hole **5**Kb, a depressing operation transmitting member **57** for transmitting operations of depressing a switch operating portion to be described later to the depression operating elements of the side switches **56**A and **56**B is disposed in an exposed state in such a manner as to be capable of receiving external depressing operations.

[0105] The depressing operation transmitting member **57** in the present example is constituted by one member in such a manner as to allow an operation of turning on or off any one of the two side switches **56**A and **56**B by seesaw movement. Specifically, as illustrated in FIGS. **3**A and **3**B, the depressing operation transmitting member **57** includes a rectangular plate-shaped body portion slightly smaller than the through hole **5**Kb of the main body unit casing **5**K of the electronic pen main body unit **5**, and also includes, below the plate-shaped body portion in a direction orthogonal to the plate surface of the plate-shaped body portion, a fulcrum leg portion **57***c* serving as a fulcrum of the seesaw movement, a depressing leg portion **57***a* for depressing the side switch **56**A, and a depressing leg portion **57***b* for depressing the side switch **56**B.

[0106] In this case, the fulcrum leg portion **57***c* is disposed at a central position in the longitudinal direction (axial direction) and the short-side direction of the plate-shaped body portion of the depressing operation transmitting member **57**. In addition, the depressing leg portion **57***a* is provided such that a distal end portion thereof depresses the depression operating element of the side switch **56**A, and the depressing leg portion **57***b* is provided such that a distal end portion thereof depresses the depression operating element of the side switch **56**B. Incidentally, the depressing leg portions **57***a* and **57***b* are set in a state of being elastically biased upward by the depression operating elements of the side switches **56**A and **56**B at all times.

[0107] On the other hand, a rectangular through hole **2**Kc is provided at an axial direction position

of the peripheral side surface of the pen tip side casing **2**K to which position the through hole **5**Kb of the main body unit casing **5**K corresponds when the electronic pen main body unit **5** is housed in the pen tip side casing **2**K. Moreover, as illustrated in FIG. **1**, FIG. **2**C, and FIGS. **3**A and **3**B, a switch operating portion **9** for the user to depress the side switches **56**A and **56**B via the depressing operation transmitting member **57** is disposed in the through hole **2**Kc of the pen tip side casing **2**K.

[0108] As illustrated in FIG. **2**C and FIGS. **3**A and **3**B, the switch operating portion **9** is formed by a plate-shaped body slightly smaller than the rectangular through hole **2**Kc of the pen tip side casing **2**K, is disposed in such a manner as to overlap the plate-shaped body portion of the depressing operation transmitting member **57**, and is configured to be able to perform seesaw movement with a fulcrum portion **9***a* as a fulcrum.

[0109] Moreover, the switch operating portion **9** includes pairs of elastically displaceable pawl portions **9***b* and **9***c* at both ends in the short-side direction at and in the vicinities of the positions of both ends in the long-side direction of the switch operating portion **9**. Further, clastic displacement of the two pairs of pawl portions **9***b* and **9***c* prevents the switch operating portion **9** from being easily detached from the rectangular through hole **2**Kc. The plate-shaped body portion of the depressing operation transmitting member **57** is smaller than the plate-shaped body of the switch operating portion **9**, and has such a size as to be inserted between the pairs of pawl portions **9***b* and **9***c* in the width direction of the switch operating portion **9**.

[0110] When the electronic pen main body unit **5** is inserted into the pen tip side casing **2**K from the rear end side, the electronic pen main body unit **5** is inserted such that the through hole **2**Kc of the pen tip side casing **2**K is positioned above the through hole **5**Kb of the main body unit casing **5**K.

[0111] However, as illustrated in FIG. **3**A, in the initial state in which the pen tip portion **5***a* of the electronic pen main body unit **5** does not protrude from the pen tip side casing **2**K, the position of the through hole **5**Kb of the main body unit casing **5**K and the position of the through hole **2**Kc of the pen tip side casing **2**K are displaced from each other in the axial direction such that depressing operation by the switch operating portion **9** is disabled.

[0112] Specifically, in the initial state illustrated in FIG. **3**A, the main body unit casing **5**K of the electronic pen main body unit **5** is present directly under an end portion on the pen tip side in the longitudinal direction of the switch operating portion **9**, and the fulcrum leg portion **57***c* of the depressing operation transmitting member **57** is present directly under the rear end side in the longitudinal direction of the switch operating portion **9**, disabling an operation of depressing the switch operating portion **9**.

[0113] As illustrated in FIG. **3**B, when the electronic pen **1** is then set in the usable state in which the pen tip portion **5***a* of the electronic pen main body unit **5** protrudes from the pen tip side casing **2**K, the position of the fulcrum **9***a* of the switch operating portion **9** and the position of the fulcrum leg portion **57***c* of the depressing operation transmitting member **57** coincide with each other in the axial direction. When the pen tip side of the fulcrum **9***a* of the switch operating portion **9** is then depressed, the depressing operation is transmitted to the depressing leg portion **57***a* of the depressing operation transmitting member **57**, and the side switch **56**A is turned on. In addition, when the rear end side of the fulcrum **9***a* of the switch operating portion **9** is depressed, the depressing operation is transmitted to the depressing leg portion **57***b* of the depressing operation transmitting member **57**, and the side switch **56**B is turned on.

[0114] In the electronic pen **1** according to the present embodiment, information regarding on/off operations of the side switches **56**A and **56**B is transmitted, as changes in resonance frequency of the resonance circuit of the electronic pen main body unit **5**, to the position detecting sensor.

[0115] Moreover, in the present embodiment, a battery **58** as a power supply is housed on the rear end side of the main body unit casing **5**K of the electronic pen main body unit **5**. The battery **58** in the present example is a secondary battery (rechargeable battery). As will be described later, a

charging circuit for the battery **58** is provided to the circuit board **50**.
[0116] The circuit board **50** is also provided with a control circuit, and is mounted with an identification (ID) memory storing identification information of the electronic pen main body unit **5** and other electronic parts.
[0117] Description will next be made of electric parts arranged on the circuit board **100** provided within the rear end side inner casing **12**.
[0118] In the present embodiment, as described earlier, the mode switching is performed by changing the resonance frequency of the resonance circuit of the electronic pen **1** of the electromagnetic induction system. Therefore, in the present embodiment, the circuit board **100** is provided with a capacitor **101** whose connection to the resonance circuit of the electronic pen main body unit **5** is controlled by the mode switching switch **15**. In addition, in the present embodiment, the circuit board **100** is provided with a wireless communication unit **102** for wirelessly transmitting information regarding a pen pressure value detected by the electronic pen main body unit **5** and the identification information stored in the ID memory of the electronic pen main body unit **5** to the outside, for example, an electronic device including a position detecting sensor. The wireless communication unit **102** is constituted by a wireless communication unit that performs short-range wireless communication of a Bluetooth (registered trademark) standard, for example.
[0119] In addition, as illustrated in FIGS. **3**A and **3**B, in the present embodiment, a universal serial bus (USB) terminal **16** (see FIG. **2**B) is provided as an example of an external connection terminal to the rear end side of the rear end side inner casing **12**. The USB terminal **16** is electrically connected to the circuit board **100**. The USB terminal **16** is held by a USB terminal holding member **17** provided to the rear end side of the rear end side inner casing **12**, in a state in which a connector jack of the USB terminal **16** can be exposed to the outside. Incidentally, as illustrated in FIGS. **3**A and **3**B, the connector jack of the USB terminal **16** exposed on the rear end side of the rear end side casing **3**K is closed by the rear end side cap **18** (see FIG. **2**C). When the rear end side cap **18** is removed, the connector jack of the USB terminal **16** is exposed to the outside.
Example of Configuration of Electronic Circuit of Electronic Pen **1** According to Embodiment
[0120] FIG. **8** is a block diagram illustrating an example of an electronic circuit configuration of the electronic pen **1** described above. As illustrated in FIG. **8**, for the electronic circuit of the electronic pen **1**, the circuit board **50** provided within the electronic pen main body unit **5** within the pen tip side module **2** and the circuit board **100** provided within the rear end side inner casing **12** of the rear end side module **3** are connected to each other via the flexible cable **8**.
[0121] On the circuit board **50**, a resonance circuit **50**RC is formed by connecting the coil **51** and the capacitor **54** in parallel with each other. Moreover, in the present embodiment, the turning on of the side switches **56**A and **56**B is detected on a position detecting device side as a change in the resonance frequency of the resonance circuit **50**RC. To this end, capacitors **501** and **502** are arranged on the circuit board **50**, a series circuit of the side switch **56**A and the capacitor **501** is connected in parallel with the coil **51**, and a series circuit of the side switch **56**B and the capacitor **502** is connected in parallel with the coil **51**.
[0122] In addition, on the circuit board **50**, a switch circuit **503** for controlling the on/off states of resonance operation of the resonance circuit **50**RC is connected in parallel with the coil **51**.
[0123] In addition, in the electronic pen **1** according to the present embodiment, a control circuit **510** constituted by an integrated circuit (IC), for example, is provided to the circuit board **50**. Moreover, the circuit board **50** is provided with a power supply circuit **504** for generating a power supply voltage Vcc from the voltage of the battery **58**, a charging circuit **505** for the battery **58**, and an ID memory **506** storing the identification information of the electronic pen main body unit **5**. The ID memory **506** is constituted by a nonvolatile memory.
[0124] Moreover, the power supply voltage Vcc from the power supply circuit **504** is supplied to the control circuit **510** and each of parts that need the power supply voltage. The control circuit **510** is connected with the ID memory **506**, and is also connected with a variable capacitance capacitor

55C constituted by the pen pressure detecting unit **55**. The variable capacitance capacitor **55**C is connected with a resistor **507** for discharge. In addition, the control circuit **510** supplies a switching control signal to the switch circuit **503**, and thereby performs on-off control of the switch circuit **503**.

[0125] The control circuit **510** in the present embodiment detects the capacitance of the variable capacitance capacitor **55**C by measuring a discharge time from a full charge of the variable capacitance capacitor **55**C. The control circuit **510** thereby detects the pen pressure. Moreover, in the present example, the control circuit **510** converts the value of the detected pen pressure into a digital signal, and performs switching control of the switch circuit **503** by the digital signal. The control circuit **510** thereby interrupts the resonance operation of the resonance circuit **50**RC. The control circuit **510** thus transmits the digital information of the pen pressure value as an amplitude shift keying (ASK) modulated signal or an on off keying (OOK) modulated signal to the position detecting device through the position detecting sensor.

[0126] Incidentally, instead of transmitting, to the position detecting sensor side, the information regarding the pen pressure value as digital information as in the present example, it is also possible to transmit, to the position detecting sensor side, the information regarding the pen pressure value as a change in the resonance frequency of the resonance circuit **50**RC by connecting the variable capacitance capacitor **55**C in parallel with the coil **51** of the resonance circuit **50**RC.

[0127] Meanwhile, the circuit board **100** is provided with a series circuit of the capacitor **101** and the mode switching switch **15**. One terminal and another terminal of the series circuit of the capacitor **101** and the mode switching switch **15** are connected in parallel with the coil **51** of the resonance circuit **50**RC on the circuit board **50** via the flexible cable **8**. Hence, when the mode switching switch **15** is turned on by rotating the rear end side module **3** by 240 degrees with respect to the pen tip side module **2**, the capacitor **101** is connected to the resonance circuit **50**RC, and the resonance frequency changes.

[0128] In the present embodiment, the position detecting device receives the signal from the electronic pen **1** via the position detecting sensor, and detects a change in the frequency of the received signal (resonance frequency). The position detecting device thereby detects that a mode switching operation has been performed in the electronic pen **1**. Incidentally, a mode switched by the mode switching in the electronic pen **1** is determined in advance in the position detecting device or the electronic apparatus including the position detecting device. The switched mode in this case may be fixedly determined. Alternatively, assignable several modes may be prepared in advance, and the switched mode may be selected and set in advance from among these modes.

[0129] In this case, as examples of the switched mode, the following are possible: [0130] switching between a writing mode and an erasing mode [0131] changing a writing color (from black to red, for example) [0132] changing the thickness of a writing line [0133] changing a kind of a writing line (for example, a solid line, a broken line, alternate long and short dashed lines, a chain double-dashed line, or the like)

[0134] The USB terminal **16** provided to the circuit board **100** has functions of a USB interface. A charging current externally supplied through the USB terminal **16** when an external USB connector plug is fitted to the USB connector jack is supplied from the circuit board **100** through the flexible cable **8** to the charging circuit **505**. In addition, a communication path of signals transmitted and received to and from the outside through the USB terminal **16** is formed as a communication path including the USB terminal **16** on the circuit board **100**, the flexible cable **8**, and the control circuit **510** on the circuit board **50**.

[0135] In addition, in the present embodiment, the power supply voltage Vcc from the power supply circuit **504** on the circuit board **50** is supplied, via the flexible cable **8**, to the wireless communication unit **102** provided to the circuit board **100**.

[0136] Moreover, in the present embodiment, the identification information of the electronic pen main body unit **5** from the control circuit **510** on the circuit board **50** is supplied to the wireless

communication unit **102** on the circuit board **100** via the flexible cable **8**. Hence, the wireless communication unit **102** in the present embodiment operates to wirelessly transmit the identification information of the electronic pen main body unit **5** to the position detecting device configured to be capable of wireless communication with the wireless communication unit **102** or the electronic apparatus including the position detecting device, on the basis of a control instruction of the control circuit **510**.

[0137] Incidentally, instead of transmitting the identification information of the electronic pen main body unit **5** through the wireless communication unit **102**, as with the information regarding the pen pressure value, the identification information of the electronic pen main body unit **5** may also be transmitted as an ASK modulated signal or an OOK modulated signal to the position detecting device through the position detecting sensor. In addition, the information regarding the pen pressure value and information regarding the on/off states of the side switches **56**A and **56**B may be wirelessly transmitted to the position detecting device or the electronic apparatus including the position detecting device through the wireless communication unit **102**.

[0138] Moreover, in the present embodiment, the control circuit **510** receives a signal from an external device such as the position detecting device through the wireless communication unit **102**, and thereby performs, for example, timing control of the interaction of a signal for position detection or the like through the resonance circuit **50**RC with the position detecting sensor provided to the external device such as the position detecting device.

Effects Produced by Electronic Pen **1** According to Embodiment

[0139] In the electronic pen **1** according to the foregoing embodiment, the rear end side module **3** is coupled in a rotatable state to the pen tip side module **2**, the electronic pen main body unit **5** including the first circuit board **50** is housed within the pen tip side module **2**, and the second circuit board **100** is housed in the rear end side module **3**. Moreover, the first circuit board **50** within the pen tip side module **2** and the second circuit board **100** in the rear end side module **3** are electrically connected to each other by the flexible cable **8**.

[0140] Since a circuit board is divided into the first circuit board **50** in the pen tip side module **2** and the second circuit board **100** in the rear end side module **3** as described above, a circuit part for a function to be added to the electronic pen main body unit **5** can be formed on the second circuit board **100** side, and the electronic pen **1** can be constructed by using an existing circuit board as it is or slightly reworking the existing circuit board as the first circuit board **50** of the electronic pen main body unit **5**. Hence, the electronic pen main body unit **5** can be used in the electronic pen **1** as it is or after being slightly reworked.

[0141] Moreover, the electronic pen **1** according to the foregoing embodiment is configured such that a predetermined instruction by the user, that is, an operation of protruding or retracting the electronic pen main body unit **5** or an operation for the mode switching of the electronic pen **1**, is performed by rotating a second casing about the axial direction of a first casing with respect to the first casing. Thus, a knock operation mechanism or a new operating unit such as a push-button switch for a mode switching operation is rendered unnecessary.

[0142] Moreover, in the electronic pen **1** according to the foregoing embodiment, the first circuit board **50** in the pen tip side module **2** and the second circuit board **100** in the rear end side module **3** are electrically connected to each other by the flexible cable **8**, and the flexible cable **8** is disposed in a state of having the surplus portion **8***a* that can be extended or contracted in the axial direction and can be twisted in rotational directions about the axial direction.

[0143] Hence, even when the rear end side module **3** is rotated about the axial direction with respect to the pen tip side module **2**, a displacement caused to the flexible cable **8** by the rotation is accommodated by the part of the surplus portion **8***a*. Thus, the electric connection state is maintained stably without an overload being applied to connecting portions between the flexible cable **8** and the first circuit board **50** and between the flexible cable **8** and the second circuit board **100**.

[0144] In addition, the electronic pen **1** according to the foregoing embodiment is configured such that the rotating cam portion **14** is formed at the pen tip side end portion of the rear end side inner casing **12** housed within the rear end side casing **3**K of the rear end side module **3**, and such that the sliding member **4** is slidingly moved in the axial direction by the rotating cam portion **14**. There are consequently advantages of simplifying the configuration of the mechanism for protruding and retracting the pen tip portion **5***a* of the electronic pen main body unit **5** from and into the pen tip side casing **2**K of the pen tip side module **2** and obviating a need for special parts for protruding and retracting the pen tip portion **5***a* of the electronic pen main body unit **5**.

Another Example of Electronic Circuit of Electronic Pen

[0145] In the electronic pen **1** according to the foregoing embodiment, the switch **15** provided to the rear end side inner casing **12** of the rear end side module **3** is assumed to be a switch for mode switching. However, the switch **15** may be configured to be a switch that controls activation of the operation of interaction of the electronic pen with the position detecting sensor and non-activation of the interaction operation (stopped state of the interaction operation).

[0146] FIG. **9** is a diagram illustrating an example of an electronic circuit configuration in a case where a switch **15**A provided to the rear end side inner casing **12** of the rear end side module **3** is used as a switch that performs switching control of activation and non-activation of the operation of interaction of an electronic pen with the position detecting sensor in the case of the electronic pen of the electromagnetic induction system as in the foregoing embodiment.

[0147] In the present example, the switch **15**A has a configuration similar to that of the switch **15** according to the foregoing embodiment. However, the switch **15**A is configured to be in an on state in the initial state of the electronic pen, and to be in an off state in the usable state. This configuration can be realized by changing the positional relation in the circumferential direction (rotational direction of the rear end side module **3**) between the pressing cam piece **7***e* of the coupling member **7** and the switch **15**A from that of the electronic pen **1** according to the foregoing embodiment.

[0148] Specifically, the switch **15**A is configured to be on in the initial state of the electronic pen by engaging the pressing cam piece **7***e* of the coupling member **7** with the switch **15***a* and thereby holding the movable contact **152***b* in contact with the fixed contact **151***b*. The switch **15**A is configured to, when the rear end side module **3** is then rotated by 180 degrees from the initial state and the usable state is thereby set, be off by setting the pressing cam piece **7***e* of the coupling member **7** in a state of not being engaged with the switch **15***a* and thereby separating the movable contact **152***b* and the fixed contact **151***b* from each other.

[0149] As illustrated in FIG. **9**, in the present example, the switch **15**A on the circuit board **100** side is configured to be connected in parallel with the coil **51** of the resonance circuit **50**RC of the circuit board **50** via the flexible cable **8**. Otherwise, the example of the electronic circuit configuration in FIG. **9** is similar to the example of the electronic circuit configuration in FIG. **8**.

[0150] In the example of FIG. **9**, in the initial state of the electronic pen in which the switch **15**A is on, both terminals of the coil **51** of the resonance circuit **50**RC are short-circuited, and therefore, the resonance circuit **50**RC stops resonance operation. Then, in the usable state of the electronic pen in which the switch **15**A is set in an off state, the resonance circuit **50**RC starts the resonance operation, and the electronic pen performs signal interaction with the position detecting sensor.

[0151] Incidentally, also in the example of FIG. **9**, it is possible to adopt a configuration in which the switch **15** is provided in addition to the switch **15**A in order to perform the mode switching by rotating the rear end side module **3** by 180 degrees+60 degrees with respect to the pen tip side module **2**. Alternatively, a configuration in which only the switch **15**A is provided while the switch **15** is omitted may be adopted. In this case, it suffices for the rear end side module **3** to be configured to be capable of rotation by only 180 degrees with respect to the pen tip side module **2**.

[0152] Next, FIG. **10** is a diagram illustrating an example of an electronic circuit configuration in a case where a switch **15**B provided to the rear end side inner casing **12** of the rear end side module **3**

is used as a switch that performs switching control of activation and non-activation of the operation of interaction of an electronic pen with the position detecting sensor in a case of an electronic pen of an active capacitive system.

[0153] Incidentally, in the example of the electronic circuit configuration of the electronic pen of the active capacitive system in the example of FIG. **10**, parts that can be configured to be similar to those of the electronic pen **1** of the above-described electromagnetic induction system will be described with the reference numerals in the foregoing embodiment given thereto as they are in order to facilitate description.

[0154] The electronic pen of the active capacitive system in the present example includes a core body **511** formed by a conductive member and a signal transmitting circuit **512** in place of the resonance circuit **50**RC. Moreover, in the present example, a control circuit **510**AES for the electronic pen of the active capacitive system is provided. The signal transmitting circuit **512** receives a control signal from the control circuit **510**AES, and transmits a signal of a predetermined frequency. The signal transmitting circuit **512** also modulates the signal to be transmitted, on the basis of the control signal from the control circuit **510**AES.

[0155] In the present example, the control circuit **510**AES is connected with the ID memory **506**, and is also connected with the variable capacitance capacitor **55**C formed by the pen pressure detecting unit **55** and the resistor **507** for discharge. As in the foregoing embodiment, the control circuit **510**AES has a function of detecting the capacitance of the variable capacitance capacitor **55**C by measuring a discharge time from a full charge of the variable capacitance capacitor **55**C, and detecting a pen pressure value from the detected capacitance.

[0156] In addition, in the present example, the side switches **56**A and **56**B are connected to the control circuit **510**AES, and the control circuit **510**AES is configured to detect the on/off states of the side switches **56**A and **56**B.

[0157] Moreover, in the present example, the fixed contact **151***b* and the movable contact **152***b* of the switch **15**B provided to the rear end side inner casing **12** of the rear end side module **3** are connected to the control circuit **510**AES on the circuit board **50** via the circuit board **100** and the flexible cable **8**.

[0158] The switch **15**B in the present example is in an off state in the initial state in which the pen tip portion **5***a* of the electronic pen main body unit **5** is housed and protected within the pen tip side casing **2**K. In addition, the switch **15**B is configured to be on in the usable state in which the rear end side module **3** is rotated by, for example, 180 degrees about the axial direction with respect to the pen tip side module **2** and the pen tip portion **5***a* of the electronic pen main body unit **5** thereby protrudes from the opening **2**Kb of the pen tip side casing **2**K. This configuration can be realized by changing the positional relation in the circumferential direction (rotational direction of the rear end side module **3**) between the pressing cam piece **7***e* of the coupling member **7** and the switch **15**B from that of the electronic pen **1** according to the foregoing embodiment such that the switch **15**B is on in the usable state in which the rear end side module **3** is rotated by 180 degrees.

[0159] Incidentally, also in the example of FIG. **10**, it is possible to adopt a configuration in which the switch **15** is provided in addition to the switch **15**B in order to perform the mode switching by rotating the rear end side module **3** by 180 degrees+60 degrees with respect to the pen tip side module **2**. Alternatively, a configuration in which only the switch **15**B is provided while the switch **15** is omitted may be adopted. In this case, it suffices for the rear end side module **3** to be configured to be capable of rotation by only 180 degrees with respect to the pen tip side module **2**.

[0160] The control circuit **510**AES monitors the on/off state of the switch **15**B. The control circuit **510**AES performs control to prevent the power supply voltage Vcc from being generated from the power supply circuit **504** by a control signal CT supplied to the power supply circuit **504**, at a time of the initial state of the electronic pen in which the switch **15**B is off. Moreover, at a time of the usable state of the electronic pen in which the switch **15**B is on, the control circuit **510**AES performs control to cause the power supply voltage Vcc to be generated from the power supply

circuit **504** by the control signal CT supplied to the power supply circuit **504**. Incidentally, even when the power supply voltage Vcc is not generated, a voltage that enables the monitoring of the on/off state of the switch **15**B and the above-described operations (which voltage is lower than the power supply voltage Vcc) is supplied from the power supply circuit **504** to the control circuit **510**AES.

[0161] Moreover, also in the present example, the wireless communication unit **102** disposed on the circuit board **100** provided to the rear end side inner casing **12** is supplied with the power supply voltage Vcc through the flexible cable **8** from the power supply circuit **504** on the circuit board **50** provided to the electronic pen main body unit **5**, and the control circuit **510**AES and the wireless communication unit **102** are connected to each other through the flexible cable **8**.

[0162] Moreover, in the present example, the control circuit **510**AES performs control to transmit the information regarding the detected pen pressure value, the identification information of the electronic pen main body unit **5** stored in the ID memory **506**, and information regarding the on/off states of the side switches **56**A and **56**B to the external device such as the position detecting device through the wireless communication unit **102**.

[0163] Incidentally, instead of wirelessly transmitting all of the information regarding the pen pressure value, the identification information of the electronic pen main body unit **5** stored in the ID memory **506**, and the information regarding the on/off states of the side switches **56**A and **56**B by use of the wireless communication unit **102**, one or two or more (which may be all) of these pieces of information may be configured to be transmitted to the position detecting sensor through the core body **511** together with a signal for position detection by changing the frequency of the signal from the signal transmitting circuit **512** or subjecting the signal to modulation (for example, ASK modulation, OOK modulation, or the like).

[0164] Further, in the present example, the control circuit **510**AES receives a wireless signal from the external device such as the position detecting device through the wireless communication unit **102**, and thereby performs, for example, timing control of the interaction of a signal for position detection or the like through the core body **511** with the position detecting sensor provided to the external device such as the position detecting device.

[0165] As described above, the electronic circuit of the electronic pen in the present example is configured to perform control to generate the power supply voltage Vcc from the power supply circuit **504** only in the usable state by turning on/off the switch **15**B. Thus, the rechargeable battery **58** is consumed only in the usable state, so that power saving can be achieved in the electronic pen.

[0166] Incidentally, it is needless to say that the example of FIG. **10** is not limited to the case of the electronic pen of the active capacitive system and is similarly applicable also to the case of the electronic pen of the electromagnetic induction system described above.

OTHER EMBODIMENTS OR MODIFICATIONS

[0167] Incidentally, while examples such as the mode switching and the activation and non-activation of the operation of the electronic pen have been cited as applications (control instruction mode) associated with the turning on and off of the switch provided to the rear end side inner casing **12**, the applications are not limited to these. For example, whether additional information such as the information regarding the pen pressure value, the identification information of the electronic pen main body unit **5** stored in the ID memory **506**, and the information regarding the on/off states of the side switches **56**A and **56**B is received through the wireless communication unit **102** or received through signal interaction between the electronic pen and the position detecting sensor is generally determined in advance for each position detecting device.

[0168] Accordingly, when whether to transmit the additional information through the wireless communication unit or transmit the additional information through signal interaction between the electronic pen and the position detecting sensor is configured to be changed by turning on or off the switch **15** according to the configuration of the position detecting device, the electronic pen can be used in cooperation with position detecting devices having different directions of receiving the

additional information. That is, the turning on/off of the switch **15** can be used to change a method of transmitting the additional information.

[0169] Incidentally, while only one switch **15** is provided at a predetermined angular position of the peripheral side surface of the rear end side inner casing **12** of the rear end side module **3** in the foregoing embodiment, a configuration in which a plurality of switches **15** are provided at different angular positions can be adopted.

[0170] For example, in the foregoing embodiment, the switch **15** is provided only at an angular position at which the switch **15** is turned on by the pressing cam piece **7***e* of the coupling member **7** when the rear end side module **3** is rotated by 240 degrees. However, a switch **15**′ having a configuration similar to that of the switch **15** may be further provided at an angular position at which the switch **15**′ is turned on by the pressing cam piece **7***e* of the coupling member **7** when the rear end side module **3** is further rotated by 60 degrees (total of 300 degrees), and the turning on and off of the switch **15**′ may be assigned to a control instruction mode different from the control instruction mode (the mode switching, a control instruction for the operation or non-operation of the electronic pen, or the like) assigned to the turning on and off of the switch **15**.

[0171] Incidentally, the number of switches provided to the peripheral side surface of the rear end side inner casing **12** of the rear end side module **3** is not limited to two and, needless to say, may be three or more, and respective different control instruction modes can be assigned to the turning on and off of these plurality of switches.

[0172] In addition, in the foregoing embodiment, the electronic pen **1** is configured such that the electronic pen main body unit **5** is provided within the pen tip side casing **2**K of the pen tip side module **2**, and the electronic pen **1** is configured such that the pen tip portion **5***a* of the electronic pen main body unit **5** is protruded and retracted from the opening **2**Kb of the pen tip side casing **2**K. However, the present disclosure does not necessarily require the configuration in which the pen tip portion **5***a* of the electronic pen main body unit **5** is protruded and retracted from the opening **2**Kb of the pen tip side casing **2**K, and the present disclosure is applicable to all of configurations in which the rear end side module **3** is coupled to the pen tip side module **2** with the axial direction as a center and an instruction of the user (a mode switching instruction, a control instruction for the operation or non-operation of the electronic pen, or the like) is given by the rotation of the rear end side module **3**.

[0173] For example, as in the electronic pen **1** according to the foregoing embodiment, the pen tip side module **2** and the rear end side module **3** are rotatably coupled to each other by providing the coupling member **7** on the pen tip side casing **2**K side and providing the tubular member **11** configured to be fitted into the recessed portion **7***a* of the coupling member **7** on the rear end side module **3** side. In this case, the rotating cam portion **14** is not formed at the rear end side inner casing **12** of the rear end side module **3**, nor is the sliding member **4** provided. A click operation of rotation is performed by the following configuration not using the rotating cam portion **14**.

[0174] Specifically, as illustrated in FIG. **11**, the recessed portion **7***a* of the coupling member **7** is provided with longitudinal grooves **7***f* in the axial direction at given rotational angle intervals, and the tubular member **11** is provided with ridges **1** If to be fitted into the longitudinal grooves **7***f*. Thus, the rotation is realized such that a state of locking in a clicking manner is produced at a position at which the longitudinal grooves **7***f* and the ridges **1** If are fitted to each other when the rear end side module **3** is rotated. Moreover, a plurality of switches (not illustrated in FIG. **11**) having a configuration similar to that of the switch **15** are provided to the peripheral side surface of the rear end side inner casing **12** in such a manner as to correspond to respective angular positions at which the switches are locked in a clicking manner. Moreover, a pressing cam piece **7***e* that turns on and off these switches is formed on the coupling member **7** in advance as in the foregoing embodiment.

[0175] With the configuration as in the example of FIG. **11**, when the rear end side module **3** is rotated, a different switch is turned on at each locking position at which the ridges **11***f* of the

tubular member **11** are fitted to the longitudinal grooves **7***f* of the coupling member **7**. Hence, an electronic pen that executes different control instruction modes at respective rotational angles by which the rear end side module **3** is rotated can be constructed by assigning the different control instruction modes to the respective switches in advance, as described above.
[0176] Incidentally, the peripheral surface of the recessed portion **7***a* of the coupling member **7** may be provided with ridges instead of being provided with the longitudinal grooves **7***f*, and the inner wall surface of the tubular member **11** may be provided with longitudinal grooves instead of being provided with the ridges **11***f*. In addition, a combination of recessed holes and protruding portions may be adopted instead of the combination of the longitudinal grooves and the ridges.
[0177] In the embodiment described above, a switch that mechanically drives a contact piece of the switch with the rotation of the rear end side module **3** is used as a section for detecting an instruction of the user by the rotation of the rear end side module **3** with respect to the pen tip side module **2**. However, the section is not limited to such a mechanical switch.
[0178] For example, there may be adopted a configuration in which a magnetic field (magnetic flux) generating section such as a permanent magnet or an electromagnet is provided to the pen tip side module **2** side and a magnetic field detecting section (magnetic flux detecting section) for detecting a magnetic field (magnetic flux) of the permanent magnet, the electromagnet, or the like is provided to the rear end side module **3** side. An instruction of the user by the rotation of the rear end side module **3** may be detected from a detection output of the magnetic field detecting section (magnetic flux detecting section). In addition, there may be adopted a configuration in which the detection is performed optically by providing a light emitting source to the pen tip side module and providing a light receiving sensor to the rear end side module **3**.
[0179] Incidentally, it is needless to say that a section for coupling between the pen tip side module **2** and the rear end side module **3** is not limited to the configuration using the coupling member **7** and the tubular member **11** and that various configurations are possible as the section for coupling between the pen tip side module **2** and the rear end side module **3**.
[0180] In addition, the configuration housed in the pen tip side module **2** is not limited to the configuration of the modularized electronic pen main body unit **5**, and may not be integrally modularized as long as the configuration has a circuit board and has a function of performing signal interaction with the position detecting sensor.
[0181] It is to be noted that the embodiment of the present disclosure is not limited to the foregoing embodiments, and that various changes can be made without departing from the spirit of the present disclosure.
[0182] The various embodiments described above can be combined to provide further embodiments. All of the U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification and/or listed in the Application Data Sheet are incorporated herein by reference, in their entirety. Aspects of the embodiments can be modified, if necessary to employ concepts of the various patents, applications and publications to provide yet further embodiments
[0183] These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

Claims

1. An electronic pen comprising: a first casing that has an opening on a pen tip side of the first casing; and a second casing that is configured to be rotatably coupled to the first casing in an axial direction of the first casing; wherein the first casing includes a first circuit, wherein the second

casing includes a second circuit connected to the first circuit, and wherein the first circuit and the second circuit are electrically connected to each other by a cable having a portion that is extendable or contractable in the axial direction of the first casing.

2. The electronic pen according to claim 1, wherein an operation mode of the electronic pen is changed by rotating the second casing about the axial direction of the first casing with respect to the first casing.

3. The electronic pen according to claim 2, wherein the electronic pen is changed to a plurality of different operation modes according to a difference in magnitude of a rotational angle of the second casing about the axial direction with respect to the first casing.

4. The electronic pen according to claim 2, wherein the second casing is provided with a switch that, in operation, is turned on or off to change the operation mode of the electronic pen when the second casing is rotated about the axial direction of the first casing with respect to the first casing.

5. The electronic pen according to claim 1, wherein operation of the electronic pen is started by rotating the second casing in a first direction about the axial direction of the first casing with respect to the first casing, and operation of the electronic pen is stopped by rotating the second casing in a second direction opposite to the first direction.

6. The electronic pen according to claim 5, wherein the second casing is provided with a switch that, in operation, is turned on or off to control starting of the operation of the electronic pen or stopping of the operation of the electronic pen when the second casing is rotated about the axial direction of the first casing with respect to the first casing.

7. The electronic pen according to claim 1, wherein the second circuit of the second casing is provided with a wireless communication circuit.

8. The electronic pen according to claim 1, wherein the second casing is provided with an external connection terminal electrically connected to the second circuit.

9. The electronic pen according to claim 1, wherein the first casing includes a rechargeable battery, and the second casing is provided with a charging terminal electrically connected to the second circuit.

10. The electronic pen according to claim 1, wherein: an electronic pen main body unit including the first circuit is housed within the first casing, and the electronic pen includes a protruding and retracting mechanism that, in operation, slidingly moves the electronic pen main body unit in the axial direction of the first casing and protrudes, from the opening of the first casing, a front end portion of a pen tip side of the electronic pen main body unit in a state of the electronic pen main body unit not protruding from the opening in the first casing, when the second casing is rotated in a first direction about the axial direction of the first casing with respect to the first casing, and returns the front end portion of the pen tip side of the electronic pen main body unit to the state of the electronic pen main body unit not protruding from the opening in the first casing, when the second casing is rotated in a second direction opposite to the first direction.

11. An electronic pen comprising: a first casing that has an opening on a pen tip side of the first casing; and a second casing that is configured to be rotatably coupled to the first casing in an axial direction of the first casing; wherein the first casing includes a first circuit, wherein the second casing includes a second circuit connected to the first circuit, and wherein the first circuit and the second circuit are electrically connected to each other by a cable having a portion that is twistable in a rotational direction about the axial direction of the first casing.

12. The electronic pen according to claim 1, wherein an operation mode of the electronic pen is changed by rotating the second casing about the axial direction of the first casing with respect to the first casing.

13. The electronic pen according to claim 12, wherein the electronic pen is changed to a plurality of different operation modes according to a difference in magnitude of a rotational angle of the second casing about the axial direction with respect to the first casing.

14. The electronic pen according to claim 12, wherein the second casing is provided with a switch

that, in operation, is turned on or off to change the operation mode of the electronic pen when the second casing is rotated about the axial direction of the first casing with respect to the first casing.

15. The electronic pen according to claim 11, wherein operation of the electronic pen is started by rotating the second casing in a first direction about the axial direction of the first casing with respect to the first casing, and operation of the electronic pen is stopped by rotating the second casing in a second direction opposite to the first direction.

16. The electronic pen according to claim 15, wherein the second casing is provided with a switch that, in operation, is turned on or off to control starting of the operation of the electronic pen or stopping of the operation of the electronic pen when the second casing is rotated about the axial direction of the first casing with respect to the first casing.

17. The electronic pen according to claim 11, wherein the second circuit of the second casing is provided with a wireless communication circuit.

18. The electronic pen according to claim 11, wherein the second casing is provided with an external connection terminal electrically connected to the second circuit.

19. The electronic pen according to claim 11, wherein the first casing includes a rechargeable battery, and the second casing is provided with a charging terminal electrically connected to the second circuit.

20. The electronic pen according to claim 11, wherein: an electronic pen main body unit including the first circuit is housed within the first casing, and the electronic pen includes a protruding and retracting mechanism that, in operation, slidingly moves the electronic pen main body unit in the axial direction of the first casing and protrudes, from the opening of the first casing, a front end portion of a pen tip side of the electronic pen main body unit in a state of the electronic pen main body unit not protruding from the opening in the first casing, when the second casing is rotated in a first direction about the axial direction of the first casing with respect to the first casing, and returns the front end portion of the pen tip side of the electronic pen main body unit to the state of the electronic pen main body unit not protruding from the opening in the first casing, when the second casing is rotated in a second direction opposite to the first direction.