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JOYSTICK WITH PREFERRED RECOVERING FUNCTION

Abstract

The joystick includes a substrate, a stick head, an actuating component, a sheathing component and a resilient recovering component. The stick head is movably located above the substrate. An identification feature is disposed on a bottom of the actuating component. The sheathing component is assembled with the actuating component. Two opposite ends of the resilient recovering component respectively abut against the substrate and the sheathing component.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation application of U.S. application Ser. No. 18/413,040, filed on Jan. 16, 2024, which is a continuation application of U.S. application Ser. No. 17/844,058, filed on Jun. 20, 2022, which claims the benefit of U.S. Provisional Application No. 63/248,548, filed on Sep. 27, 2021, and claims the benefit of U.S. Provisional Application No. 63/272,663, filed on Oct. 27, 2021. The contents of these applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a joystick, and more particularly, to a joystick with preferred recovering function.

2. Description of the Prior Art

[0003] A conventional optical joystick includes a sensor, a lever arm, a recovering component and a handle. The user presses the handle to move the lever arm, and the sensor detects motion of identification features on the lever arm to control a cursor signal output by the optical joystick. When the optical joystick is reclined, the lever arm is rotated or slanted towards specially designated directions, and the recovering component is compressed to store a resilient recovering force; when the pressure applied to the handle is removed, the resilient recovering force of the recovering component moves the lever arm back to an initial mode. Two opposite ends of the recovering component respectively contact against the lever arm and a substrate of the optical joystick. However, the optical joystick needs accurate recovering motion of the lever arm, but the two opposite ends of the recovering component may be non-parallel due to long-term usage and incorrect installation, and therefore the recovering component of the conventional optical joystick cannot be recovered to an inaccurate position. Therefore, the conventional optical joystick is operated by limited gestures, and the conventional recovering function of the recovering component cannot accurately recover the lever arm back to the predefined initial mode, so the conventional optical joystick does not have preferred detection accuracy.

SUMMARY OF THE INVENTION

[0004] The present invention provides a joystick with preferred recovering function for solving above drawbacks.

[0005] According to the claimed invention, the joystick includes a substrate, a stick head, an actuating component, a sheathing component and a resilient recovering component. The stick head is movably located above the substrate. An identification feature is disposed on a bottom of the actuating component. The sheathing component is assembled with the actuating component. Two opposite ends of the resilient recovering component respectively abut against the substrate and the sheathing component.

[0006] The joystick in the first embodiment can utilize assembly of the actuating component and the second rotation component to provide revolving movement,, and further utilize pivots between the first rotation component and the second rotation component and pivots between the first rotation component and the bearing base to provide slanting movement. The joystick in the second embodiment can dispose the constraining component inside the bearing base; the constraining component can be moved downwardly with lowering motion of the second rotation component to compress the resilient recovering component, and the resilient recovering component can push the

constraining component relative to the bearing base for recovering of the second rotation component and the stick head and the actuating component. The second embodiment can effectively achieve a stably recovering demand of the resilient recovering component via constraint of the constraining component and the bearing base, so that the joystick can have preferred detection accuracy. The joystick in the third embodiment can cover the sheathing component by the first supporting portion and the second supporting portion of the supporting component, and the sheathing component can be freely rotated or moved or slanted within the supporting component; the actuating component can be revolved via the sheathing component, and further can be operated as a universal joint by concentric assembly of the sheathing component and the supporting component.

[0007] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** and FIG. **2** are diagrams of a joystick in different views according to a first embodiment of the present invention.

[0009] FIG. **3** is an exploded diagram of the joystick according to the first embodiment of the present invention.

[0010] FIG. **4** is a sectional view of the joystick according to the first embodiment of the present invention.

[0011] FIG. **5** is an assembly diagram of an actuating component, a first rotation component and a second rotation component according to the first embodiment of the present invention.

[0012] FIG. **6** to FIG. **8** are sectional views of the joystick in other operation modes according to the first embodiment of the present invention.

[0013] FIG. **9** is an exploded diagram of the joystick according to a second embodiment of the present invention.

[0014] FIG. **10** is a sectional view of the joystick according to the second embodiment of the present invention.

[0015] FIG. **11** and FIG. **12** are sectional views of the joystick in other operation modes according to the second embodiment of the present invention.

[0016] FIG. **13** is an exploded diagram of the joystick according to a third embodiment of the present invention.

[0017] FIG. **14** is an assembly diagram of the joystick according to the third embodiment of the present invention.

[0018] FIG. **15** is a sectional view of the joystick according to the third embodiment of the present invention.

[0019] FIG. **16** and FIG. **17** are sectional views of the joystick in other operation modes according to the third embodiment of the present invention.

DETAILED DESCRIPTION

[0020] Please refer to FIG. **1** to FIG. **4**. FIG. **1** and FIG. **2** are diagrams of a joystick **10** in different views according to a first embodiment of the present invention. FIG. **3** is an exploded diagram of the joystick **10** according to the first embodiment of the present invention. FIG. **4** is a sectional view of the joystick **10** according to the first embodiment of the present invention. The joystick **10** can include a stick head **12**, an actuating component **14**, a substrate **16**, a bearing base **18**, a resilient recovering component **20**, a first rotation component **22**, a second rotation component **24** and a covering component **26**. The stick head **12** can be an operation interface of the joystick **10**.

The user can push, pull and rotate the stick head **12** to control the joystick **10** to output a corresponding control command. The actuating component **14** can be assembled with the first rotation component **22** and the second rotation component **24** in a movable manner. The actuating component **14**, the first rotation component **22** and the second rotation component **24** can be disposed on the bearing base **18** and then installed on the substrate **16**. The resilient recovering component **20** can be disposed inside the bearing base **18**. Two opposite ends of the resilient recovering component **20** can respectively contact against the substrate **16** (or the bearing base **18**) and the second rotation component **24**. The covering component **26** (which can be defined as a cover) can be disposed on the substrate **16** to cover the actuating component **14** and the bearing base **18**.

[0021] The actuating component **14** can pierce through a hollow hole formed on the second rotation component **24**, and be disposed on the second rotation component **24** via the fixing component **28** (which can be defined as a fixer). The actuating component **14** which is assembled with the second rotation component **24** can pierce through a hollow hole formed on the first rotation component **22** and be connected with the stick head **12**. The actuating component **14** can have a first end **141** and a second end **142** opposite to each other. The first end **141** can pierce through the hollow holes on the first rotation component **22** and the second rotation component **24**, and further pierce through a buttonhole **29** formed on the covering component **26** to connect with the stick head **12**. The second end **142** can have an identification feature **30**, and can be stuck with the resilient recovering component **20** to point the substrate **16**. The substrate **16** can have a detection module **32** (which can be defined as a detector). An opening portion **33** of the bearing base **18** can align with the detection module **32** and the second end **142** of the actuating component **14**. An optical detection signal emitted by a light source (which is not marked in the figures) can be projected onto the identification feature **30** of the actuating component **14**. The detection module **32** can receive an optical signal from the identification feature **30** through the opening portion **33**, and analyze the optical signal to acquire a behavior of the identification feature **30** and decide motion of the stick head **12**. The light source may be disposed adjacent to the detection module **32**, or adjacent to the identification feature **30**, or any position that can illuminate the identification feature **30**; or the identification feature **30** can have an illumination function.

[0022] The actuating component **14** can include an abutting portion **34** disposed on the second end **142** and contact against an inner surface **241** of the second rotation component **24**. The fixing component **28** can be engaged with an engaging slot **36** of the actuating component **14**, and contact against a top surface **242** of the second rotation component **24**. The actuating component **14** can be fixed on the two opposite surfaces of the second rotation component **24** via the abutting portion **34** and the fixing component **28**, so as to prevent the actuating component **14** from being separated from the second rotation component **24**. Therefore, the actuating component **14** can be revolved relative to the second rotation component **24** in a revolving axial direction Da via assembly of the abutting portion **34** and the fixing component **28**.

[0023] The first rotation component **22** can include a first bearing portion **38** movably disposed inside a first slotted portion **40** of the bearing base **18**. The first rotation component **22** can be movably assembled with the bearing base **18**, and further be rotated in a first direction DI via assembly of the first bearing portion **38** and the first slotted portion **40**. The first rotation component **22** can have structural features replaced by structural features of the bearing base **18**; for example, the first rotation component **22** may have the first slotted portion and accordingly the bearing base **18** may have the first bearing portion. In addition, the second rotation component **24** can include a second bearing portion **42** movably disposed on a second slotted portion **44** of the first rotation component **22**. The second rotation component **24** can be movably connected with the first rotation component **22**, and further can be rotated in a second direction D**2** different from the first direction DI via assembly of the second bearing portion **42** and the second slotted portion **44**. The structural features of the first bearing portion **38** and the first slotted portion **40**, and the

structural features of the second bearing portion **42** and the second slotted portion **44** are not limited to the embodiments shown in FIG. **1**, and depend on a design demand.

[0024] The resilient recovering component **20** can be disposed between the bearing base **18** and the substrate **16**. A structural height Hl of the first rotation component **22** can be greater than a structural height H**2** of the second rotation component **24**, so that the second rotation component **24** can be movably accommodated inside the first rotation component **22**. The second rotation component **24** can be held by the resilient recovering component **20** and suspended above the substrate **16**. The resilient recovering component **20** can be deformed when the second rotation component **24** is rotated relative to the first rotation component **22**. The joystick **10** can further include a first spacer **46** and a second spacer **48**. The first spacer **46** can be disposed between the second rotation component **24** and a top of the resilient recovering component **20**. The second spacer **48** can be disposed between the substrate **16** (or the bearing base **18**) and a bottom of the resilient recovering component **20**. If the stick head **12** is pressed downwardly, the resilient recovering component **20** can be compressed to store a resilient recovering force. If pressure applied on the stick head **12** is weakened or removed, the resilient recovering force of the resilient recovering component **20** can push the stick head **12** back to an initial position via the actuating component **14** and the first rotation component **22**.

[0025] In the first embodiment, the actuating component **14** can abut against the resilient recovering component **20** via the second rotation component **24** in a detachable manner, or the top of the resilient recovering component **20** can be assembled with or abut against the second rotation component **24** through the first spacer **46**. The actuating component **14** and the second rotation component **24** can be pressed downwardly and recovered simultaneously via the resilient recovering component **20**. Besides, an outer surface **243** of the second rotation component **24** can be slid relative to an inner surface **221** of the first rotation component **22** in the detachable manner, and an outer surface **222** of the first rotation component **22** can be slid relative to an inner surface **261** of the covering component **26** in the detachable manner. Please refer to FIG. **5**. FIG. **5** is an assembly diagram of the actuating component **14**, the first rotation component **22** and the second rotation component **24** according to the first embodiment of the present invention. The joystick **10** can utilize motion of the actuating component **14** relative to the second rotation component **24** to provide activity of the actuating component **14** in the revolving axial direction Da, and utilize motion of the first rotation component **22** and the second rotation component **24** relative to the bearing base **18** to provide activity of the actuating component **14** in the first direction D**1** and the second direction D**2**.

[0026] Please refer to FIG. **3**, FIG. **4**, and FIG. **6** to FIG. **8**. FIG. **6** to FIG. **8** are sectional views of the joystick **10** in other operation modes according to the first embodiment of the present invention. As shown in FIG. **4**, the joystick **10** is in the initial mode, so the resilient recovering component **20** is not compressed, and the first rotation component **22** is not rotated relative to the bearing base **18** and the second rotation component **24** is not rotated relative to the first rotation component **22**; meanwhile, the actuating component **14** can be optionally revolved relative to the second rotation component **24**, and the detection module **32** can detect the behavior of the identification feature **30** to decide the revolving angle of the joystick **10**. As shown in FIG. **7** and FIG. **8**, the stick head **12** is pushed laterally, so that the actuating component **14** and the second rotation component **24** can be rotated relative to the first rotation component **22** in the second direction D**2**, or the actuating component **14** and the first rotation component **22** and the second rotation component **24** can be rotated relative to the bearing base **18** in the first direction D**1**, and the detection module **32** can detect the behavior of the identification feature **30** to decide a slanting direction and a slanting angle of the joystick **10**.

[0027] Please refer to FIG. **9** and FIG. **10**. FIG. **9** is an exploded diagram of the joystick **10**A according to a second embodiment of the present invention. FIG. **10** is a sectional view of the joystick **10**A according to the second embodiment of the present invention. In the second

embodiment, elements having the same numerals as ones of the first embodiment have the same structures and functions, and a detailed description is omitted herein for simplicity. The joystick **10**A can include the stick head **12**, the actuating component **14**, the substrate **16**, the bearing base **18**, the resilient recovering component **20**, the first rotation component **22**, the second rotation component **24**, the covering component **26** and a constraining component **50**. Two opposite ends of the resilient recovering component **20** can respectively contact against the substrate **16** (or the bearing base **18**) and an inner surface of the constraining component **50**. The constraining component **50** can be a hollow structure covering the resilient recovering component **20**. The constraining component **50** can be movably disposed inside the opening portion **33** of the bearing base **18**. The constraining component **50** may further include a plurality of side walls or pillars disposed around the resilient recovering component **20**. The constraining component **50** can have an opening portion **52**. The detection module **32** can detect the identification features **30** through the opening portion **52** of the constraining component **50** and the opening portion **33** of the bearing base **18**. The detection module **32** can further receive the optical signal from the identification feature **30**, and analyze the optical signal to acquire the behavior of the identification feature **30** and decide the motion of the stick head **12**.

[0028] The constraining component **50** can further include a top portion **54** disposed around the opening portion **52**. The actuating component **14** (or the second rotation component **24** assembled with the actuating component **14**) can abut against the top portion **54** of the constraining component **50** in the detachable manner. When the stick head **12** is pushed laterally, a part of the actuating component **14** (or the second rotation component **24**) can abut against the top portion **54** of the constraining component **50**, and other part of the actuating component **14** (or the second rotation component **24**) can be separated from the top portion **54** of the constraining component **50**. Moreover, the opening portion **33** of the bearing base **18** can be optionally designed as a straight channel. An inner diameter of the opening portion **33** can be greater than or the same as an outer diameter of the constraining component **50**. When the stick head **12** is pressed, the constraining component **50** can be slid along the opening portion **33** designed as the straight channel, and therefore a moving direction of the constraining component **50** can be limited accordingly.

[0029] The bearing base **18** can optionally include a first constraining portion **56**, and the constraining component **50** can optionally include a second constraining portion **58**. The second constraining portion **58** can be fit with the first constraining portion **56** in a movable manner. The resilient recovering force of the resilient recovering component **20** can push the stick head **12** and the actuating component **14** upwardly via the constraining component **50**, and the constraining component **50** can be stopped when the second constraining portion **58** abuts against the top of the first constraining portion **56**. A recovering function of the pressed joystick **10**A can be limited by relative slide between the first constraining portion **56** and the second constraining portion **58**, and the stick head **12** can be stably recovered to the initial angle and the initial position. In the second embodiment, the first constraining portion **56** and the second constraining portion **58** can respectively be a slot and a slide block. The slide block can be slid along a slotted direction of the slot to constrain the moving direction of the constraining component **50**. Structures of the first constraining portion **56** and the second constraining portion **58** are not limited to the above-mentioned embodiment. For example, the first constraining portion **56** may be the slide block and the second constraining portion **58** may be the slot, or the first constraining portion **56** and the second constraining portion **58** can be designed as any cooperated structures capable of limiting the sliding direction.

[0030] Please refer to FIG. **10** to FIG. **12**. FIG. **11** and FIG. **12** are sectional views of the joystick **10**A in other operation modes according to the second embodiment of the present invention. As shown in FIG. **10**, the joystick **10**A is in the initial mode and the resilient recovering component **20** is not compressed; the first rotation component **22** is not rotated relative to the bearing base **18**, and the second rotation component **24** is not rotated relative to the first rotation component **22**, so the

actuating component **14** can be optionally revolved relative to the second rotation component **24**, and the detection module **32** can detect the behavior of the identification feature **30** to decide the revolving angle of the joystick **10**A. As shown in FIG. **11**, the stick head **12** is pressed and the resilient recovering component **20** is compressed accordingly; the constraining component **50** can be pushed by the actuating component **14** and the second rotation component **24** and moved downwardly, and the detection module **32** can detect the behavior of the identification feature **30** to decide the pressing depth of the joystick **10**A.

[0031] When the pressure applied to the stick head **12** is weakened or removed, the resilient recovering force of the resilient recovering component **20** can push the constraining component **50** upwardly, and the second constraining portion **58** can stop moving in response to the second constraining portion **58** abutting against the top of the first constraining portion **56**. As shown in FIG. **12**, the stick head **12** is laterally pressed, and the actuating component **14** and the second rotation component **24** can be laterally slanted relative to the constraining component **50** within the first rotation component **22**, or the actuating component **14** and assembly of the first rotation component **22** and the second rotation component **24** can be laterally slanted relative to the constraining component **50** within the bearing base **18**; the resilient recovering component **20** can be compressed in accordance with the constraining component **50** being pressed, and the detection module **32** can detect the behavior of the identification feature **30** to decide the slanting direction and the slanting angle of the joystick **10**A.

[0032] Please refer to FIG. **13** to FIG. **15**. FIG. **13** is an exploded diagram of the joystick **10**B according to a third embodiment of the present invention. FIG. **14** is an assembly diagram of the joystick **10**B according to the third embodiment of the present invention. FIG. **15** is a sectional view of the joystick **10**B according to the third embodiment of the present invention. The joystick **10**B can include a cover **60**, a stick head **62**, an actuating component **64**, a sheathing component **66**, a supporting component **68**, a resilient recovering component **70** and a substrate **72**. The actuating component **64** can have two engaging slots **74**. The actuating component **64** passes through the stick head **62**, and two fixing components **76** of the joystick **10**B can be engaged with the engaging slots **74** and abut against two opposite surfaces of the stick head **62** respectively, so that the actuating component **64** can be tightly assembled with the stick head **62**. The cover **60** can be disposed on the stick head **62** to shelter the top of the actuating component **64** and the fixing component **76** for preferred artistic appearance.

[0033] The supporting component **68** can include a first supporting portion **78** and a second supporting portion **80** assembled with each other. The sheathing component **66** can be covered by assembly of the first supporting portion **78** and the second supporting portion **80**, and freely moved inside inner space of the supporting component **68** in multiple directions. The sheathing component **66** can contact against an inner wall of the supporting component **68** in the slidable manner. The resilient recovering component **70** can be disposed inside the supporting component **68**. Two opposite ends of the resilient recovering component **70** can respectively abut against the sheathing component **66** and the substrate **72**. An identification feature **82** can be disposed on a bottom of the actuating component **64**. The bottom of the actuating component **64** can be stuck into the sheathing component **66** and located inside the sheathing component **66** and the supporting component **68**. The substrate **72** can have a detection module **84**. The optical detection signal emitted by the detection module **84** can enter the sheathing component **66** and the supporting component **68** and be projected onto the identification feature **82** of the actuating component **64**. The detection module **84** can further receive the optical signal from the identification feature **82**, and analyze the optical signal to detect the behavior of the identification feature **82** and decide the motion of the stick head **62**.

[0034] Please refer to FIG. **15** to FIG. **17**. FIG. **16** and FIG. **17** are sectional views of the joystick **10**B in other operation modes according to the third embodiment of the present invention. As shown in FIG. **15**, the joystick **10**B is in the initial mode and the resilient recovering component **70**

is not compressed; the sheathing component **66** is upwardly pushed by the resilient recovering component **70** to abut against the supporting component **68**, and the actuating component **64** can be optionally revolved inside the supporting component **68**, so that the detection module **84** can detect the behavior of the identification feature **82** to decide the revolving angle of the joystick **10**B. As shown in FIG. **16**, the cover **60** and the stick head **62** are pressed, so the resilient recovering component **70** is compressed accordingly; the actuating component **64** and the sheathing component **66** can be moved downwardly by pressure of the stick head **62**, and the detection module **84** can detect the behavior of the identification feature **82** to decide the pressing depth of the joystick **10**B. If the pressure applied to the stick head **62** is weakened or removed, the resilient recovering force of the resilient recovering component **70** can upwardly push the sheathing component **66** until the sheathing component **66** abuts against the inner wall of the supporting component **68**. As shown in FIG. **17**, the cover **60** and the stick head **62** are laterally pressed; the stick head **62** can utilize the actuating component **64** to move the sheathing component **66** inside the supporting component **68** in the multiple directions, and the detection module **84** can detect the behavior of the identification feature **82** to decide the slanting direction and the slanting angle of the joystick **10**B.

[0035] In conclusion, the joystick in the first embodiment can utilize assembly of the actuating component and the second rotation component to provide revolving movement,, and further utilize pivots between the first rotation component and the second rotation component and pivots between the first rotation component and the bearing base to provide slanting movement. The joystick in the second embodiment can dispose the constraining component inside the bearing base; the constraining component can be moved downwardly with lowering motion of the second rotation component to compress the resilient recovering component, and the resilient recovering component can push the constraining component relative to the bearing base for recovering of the second rotation component and the stick head and the actuating component. The second embodiment can effectively achieve a stably recovering demand of the resilient recovering component via constraint of the constraining component and the bearing base, so that the joystick can have preferred detection accuracy. The joystick in the third embodiment can cover the sheathing component by the first supporting portion and the second supporting portion of the supporting component, and the sheathing component can be freely rotated or moved or slanted within the supporting component; the actuating component can be revolved via the sheathing component, and further can be operated as a universal joint by concentric assembly of the sheathing component and the supporting component.

[0036] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

Claims

1. A joystick, comprising: a substrate; a stick head movably located above the substrate; an actuating component, an identification feature being disposed on a bottom of the actuating component; a sheathing component assembled with the actuating component; and a resilient recovering component, two opposite ends of the resilient recovering component respectively abutting against the substrate and the sheathing component.

2. The joystick of claim 1, wherein the joystick further comprises a fixing component, the actuating component comprises an engaging slot, and the fixing component is engaged with the engaging slot and abuts against the stick head.

3. The joystick of claim 1, wherein the joystick further comprises a cover disposed on the stick head to shelter the actuating component.

4. The joystick of claim 1, wherein the joystick further comprises a supporting component where inside the sheathing component is freely moved.
5. The joystick of claim 4, wherein the supporting component comprises a first supporting portion and a second supporting portion assembled with each other to cover the sheathing component.
6. The joystick of claim 4, wherein the sheathing component contacts against an inner wall of the supporting component in the slidable manner.
7. The joystick of claim 4, wherein the resilient recovering component is disposed inside the supporting component.
8. The joystick of claim 4, wherein the bottom of the actuating component is stuck into the sheathing component and located inside the supporting component.
9. The joystick of claim 4, wherein the substrate comprises a detection module, an optical detection signal emitted by the detection module enters the sheathing component and the supporting component to project onto the identification feature.
10. The joystick of claim 9, wherein the detection module receives and analyzes the optical signal from the identification feature to detect a behavior of the identification feature and decide motion of the stick head.
11. The joystick of claim 4, wherein the actuating component is revolved inside the supporting component when the sheathing component is upwardly pushed by the resilient recovering component to abut against the supporting component.
12. The joystick of claim 4, wherein the stick head utilizes the actuating component to move the sheathing component inside the supporting component in multiple directions when the stick head is laterally pressed.