United States Patent	12393288
Kind Code	B2
Date of Patent	August 19, 2025
Inventor(s)	Saijo; Takayuki

Input device

Abstract

An input device includes: a housing; an operation panel that includes an operation portion configured to receive touching and pressing from an operator, and is supported so as to be rockable relative to the housing; a substrate that is housed in the housing; an electrostatic detection electrode configured to detect the touching; and a pressure detector configured to detect the pressing. The operation portion includes a first operation portion configured to receive both of the touching and the pressing, and a second operation portion configured to receive only the touching without receiving the pressing. The input device includes a restrainer configured to differentiate operation that moves the operation panel toward the substrate upon pressing on the first operation portion from operation that moves the operation panel toward the substrate upon pressing on the second operation portion.

Inventors: **Saijo; Takayuki (Miyagi, JP)**

Applicant: **ALPS ALPINE CO., LTD.** (Tokyo, JP)

Family ID: **1000008765472**

Assignee: **ALPS ALPINE CO., LTD. (Tokyo, JP)**

Appl. No.: **18/787041**

Filed: **July 29, 2024**

Prior Publication Data

Document Identifier	Publication Date
US 20240385700 A1	Nov. 21, 2024

Foreign Application Priority Data

JP	2022-040659	Mar. 15, 2022

Related U.S. Application Data

continuation parent-doc WO PCT/JP2023/004909 20230214 PENDING child-doc US 18787041

Publication Classification

Int. Cl.: **G06F3/0354** (20130101); **H05K7/14** (20060101)

U.S. Cl.:

CPC **G06F3/03543** (20130101); **H05K7/1427** (20130101);

Field of Classification Search

CPC: G06F (3/03543); H05K (7/1427)

USPC: 345/163

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
5430261	12/1994	Malone	200/1B	H01H 23/003
2021/0134542	12/2020	Hashimoto	N/A	H01H 23/143

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
S51-026371	12/1975	JP	N/A
2006294322	12/2005	JP	N/A
2009-301854	12/2008	JP	N/A
2009301854	12/2008	JP	N/A
2021-072190	12/2020	JP	N/A

OTHER PUBLICATIONS

International Search Report for PCT/JP2023/004909 mailed on May 9, 2023. cited by applicant

---

Primary Examiner: Edwards; Mark

Attorney, Agent or Firm: IPUSA, PLLC

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation application of International Application No. PCT/JP2023/004909, filed on Feb. 14, 2023, and designated the U.S., which is based upon and claims priority to Japanese Patent Application No. 2022-040659, filed on Mar. 15, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND

1. Field of the Invention

(1) The present disclosure relates to an input device.

2. Description of the Related Art

(2) Japanese Laid-Open Patent Application No. 2021-72190 discloses a seesaw switch including a case, a knob which includes two press operation portions and is operably locked to a housing by a fulcrum provided on a side wall of the case, and two switches.

SUMMARY

(3) An input device according to one embodiment includes: a housing; an operation panel that includes an operation portion configured to receive touching and pressing from an operator, and that is supported so as to be rockable relative to the housing; a substrate that is housed in the housing; an electrostatic detection electrode configured to detect touching; and a pressure detector configured to detect the pressing. The operation portion includes a first operation portion configured to receive both touching and pressing, and a second operation portion configured to receive only touching without receiving the pressing. The operation portion includes a restrainer configured to differentiate operation that moves the operation panel toward the substrate upon pressing on the first operation portion from operation that moves the operation panel toward the substrate upon pressing on the second operation portion.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is an external perspective view of an input device according to one embodiment of the present disclosure;

(2) FIG. **2** is an external perspective view of the input device according to the embodiment;

(3) FIG. **3** is a plan view of the input device according to the embodiment;

(4) FIG. **4** is a side view of the input device according to the embodiment;

(5) FIG. **5** is an exploded perspective view of the input device according to the embodiment;

(6) FIG. **6** is a top view of a case included in the input device according to the embodiment;

(7) FIG. **7** is an external perspective view of the case included in the input device according to the embodiment;

(8) FIG. **8** is an external perspective view of an operation panel, a holder, and a first housing included in the input device according to the embodiment;

(9) FIG. **9** is an external perspective view of the operation panel, the holder, and the first housing included in the input device according to the embodiment;

(10) FIG. **10** is a cross-sectional perspective view of the input device according to the embodiment taken along the line I-I;

(11) FIG. **11** is a cross-sectional perspective view of the input device according to the embodiment taken along the line II-II;

(12) FIG. **12** is a cross-sectional perspective view of the input device according to the embodiment taken along the line III-III;

(13) FIG. **13** is a cross-sectional perspective view of the input device according to the embodiment taken along the line IV-IV;

(14) FIG. **14** is an enlarged view of a portion (a portion P**1**) of FIG. **13**;

(15) FIG. **15** is a cross-sectional perspective view of the input device according to the embodiment taken along the line V-V;

(16) FIG. **16** is an enlarged view of a portion (a portion P**2**) of FIG. **15**; and

(17) FIG. **17** is a diagram illustrating a positional relationship between a rocking axis, an area E, an area G, an area F, a first press switch and a second press switch, and a projection, in the input

device according to the embodiment.

DETAILED DESCRIPTION OF THE PRESENT DISCLOSURE

(18) According to the technique of Japanese Laid-Open Patent Application No. 2021-72190 mentioned above, there is a risk of misoperation of a switch when a portion of the switch that does not receive pressing is pressed mistakenly.

(19) An embodiment of the present disclosure will now be described with reference to the drawings.

Configuration of the Input Device **100**

(20) FIGS. **1** and **2** are external perspective views of an input device **100** according to one embodiment. FIG. **3** is a plan view of the input device **100** according to the embodiment. FIG. **4** is a side view of the input device **100** according to the embodiment. FIG. **5** is an exploded perspective view of the input device **100** according to the embodiment.

(21) In the following description, for the sake of convenience, an X-axis direction is defined as a left-right direction, a Y-axis direction is defined as a front-rear direction, and a Z-axis direction is defined as a vertical direction. However, a positive X-axis direction is defined as a right direction, a positive Y-axis direction is defined as a front direction, and a positive Z-axis direction is defined as an upward direction. These directions represent relative positional relationships within the device, and do not limit an installation direction or an operating direction of a device. All devices that have the same relative positional relationship within the device, and even those devices that have different installation directions or operating directions, are included in the scope of the present disclosure.

(22) An input device **100** as illustrated in FIGS. **1** to **5** is, for example, a device that is mounted in a cabin of a vehicle such as an automobile and receives touching and pressing from an operator.

(23) As illustrated in FIGS. **1** to **5**, the input device **100** includes an operation panel **110**, a holder **120**, a first housing **130**, a substrate **140**, a second housing **150**, and an electrostatic detection electrode sheet **180**.

(24) The operation panel **110** is a resin component that receives touching and pressing from an operator. In the present embodiment, the operation panel **110** is in a shape of a box having a hollow structure, and generally has a rectangular parallelepiped shape in which a lower surface includes a rectangular opening **111**. In a plan view from the top, the operation panel **110** has a rectangular shape in which the front-rear direction (Y-axis direction) is a longitudinal direction. The operation panel **110** is rockably supported by the first housing **130**. Specifically, the operation panel **110** is supported by the first housing **130** so as to be rockable about a rocking axis AX as illustrated in FIG. **3**.

(25) An upper surface **112** of the operation panel **110** includes a flat surface **112**A, a first inclination **112**B, and a second inclination **112**C. The flat surface **112**A is a central portion in the front-rear direction (Y-axis direction) and is a portion parallel to an XY plane. The first inclination **112**B is a portion on the front side (Y-axis positive side) of the flat surface **112**A and is a portion of an inclined surface inclined downward thereof. The second inclination **112**C is a portion on the rear side (Y-axis negative side) of the flat surface **112**A and is a portion of an inclined surface inclined downward thereof.

(26) Areas A, B, C, D, E, F, and G are provided on the upper surface **112** of the operation panel **110**. The areas A, B, D, E, and G receive both touching and pressing from an operator. The area F does not receive pressing from an operator, but only touching.

(27) For example, the area A and the area B are arranged in a left-right direction (X-axis direction) on the rear side (Y-axis negative side) of the flat surface **112**A. The area A is provided with a display portion **113-1** symbolizing the letter “A”, and the area B is provided with a display portion **113-2** symbolizing the letter “B”.

(28) The area D and the area E are arranged in a front-rear direction (Y-axis direction) on the left side (X-axis negative side) of the first inclination **112**B. The area E is an example of a “first

operation portion" provided on the front side (Y-axis positive side) of the upper surface **112**. The area D is provided with a display portion **113-3** symbolizing the letter "D", and the area E is provided with a display portion **113-4** symbolizing the letter "E".
(29) The area F is provided on the right side (X-axis positive side) of the first inclination **112**B. The area F is an example of the "second operation portion". The area F is provided with a display portion **114** symbolizing the letter "F".
(30) The area G is provided in the center of the second inclination **112**C. The area G is an example of the "first operation portion" provided on the rear side (Y-axis negative side) of the upper surface **112**. The area G is provided with a display portion **113-5** symbolizing the letter "G".
(31) The area C is provided in the center of the flat surface **112**A. A display portion **115** symbolized by the letter "C" is provided in the area C. Note that the display portion **115** in the area C merely displays a display for enhancing design, and does not receive an operation from an operator.
(32) The operation panel **110** is formed of white resin and a black coating layer, and the display portions A to G are formed by removing a part of the black coating layer using a technique such as laser processing. Through-holes are provided at portions corresponding to the display portions A to G of the holder **120**, so that when light-emitting elements **143-1** to **143-7** emit light, light from the light-emitting elements **143-1** to **143-7** irradiates the back surfaces of the display portions A to G.
(33) The holder **120** is a resin and plate-like component arranged and fixed inside the operation panel **110**. An upper surface **120**A of the holder **120** is bent along the upper surface **112** of the operation panel **110**. The holder **120** is arranged inside the operation panel **110** so as to overlap with the back surface of the upper surface **112** of the operation panel **110**. The holder **120** holds the electrostatic detection electrode sheet **180** on the upper surface **120**A thereof. The electrostatic detection electrode sheet **180** includes a connection portion (not illustrated) connected to the substrate **140**, and is electrically connected to the substrate **140**. Thus, the input device **100** can detect touching performed on the area A to the area B, and the area D to the area G of the operation panel **110** by the electrostatic detection electrode sheet **180**.
(34) The holder **120** is fixed to the operation panel **110**. The holder **120** is rockably supported by the first housing **130**. Therefore, the holder **120** and the operation panel are rockable relative to the first housing **130**. The holder **120** includes a pair of bearing holes **122**A, a pair of guide ribs **171**, a press portion **121-1**, a press portion **121-2**, and a projection **161-1**, which will be described in detail in the following. The bearing hole **122**A is shaped to be engaged with a lock portion **133** of the first housing **130**, and is shaped to support the holder **120** and the operation panel in a rockable manner and to define a rocking range. The guide rib **171** is shaped to be engaged with a guide groove **172** of the first housing **130**, and is shaped to define a rocking range between the holder **120** and the operation panel. The press portion **121-1** is shaped to press a first press switch **141**. The press portion **121-2** is shaped to press a second press switch **142**.
(35) The first housing **130** is a resin component arranged below the holder **120** in the operation panel **110**. The first housing **130** is provided so as to cover the substrate **140**. The first housing **130** rockably supports the operation panel **110** and the holder **120**. The first housing **130** is an example of a "housing". Since the first housing **130** is provided so as to cover the substrate **140**, the projection **161-1** and a projection **161-2** provided on the holder **120** can contact the first housing **130**. That is, the projections **161-1** and **161-2** can be prevented from contacting the substrate **140**, so that damage to the substrate **140** caused by the projections **161-1** and **161-2** can be prevented.
(36) The substrate **140** is a flat plate component made of resin. The substrate **140** has a rectangular shape having a front-rear direction as a longitudinal direction (Y-axis direction) in a plan view seen from the top. The substrate **140** is provided on the lower side (Z-axis negative side) of the first housing **130**, and is arranged at a predetermined height inside a peripheral wall portion **152** of the second housing **150** in a posture parallel to the XY plane. A first press switch **141** and a second press switch **142** are mounted on an upper surface **140**A of the substrate **140**. The first press switch **141** and the second press switch **142** detect pressing relative to the operation panel **110** by an

operator. The first press switch **141** is an example of a “pressure detector in which the distance to the first operation portion (area E) is longer among the two pressure detectors”. The second press switch **142** is an example of a “pressure detector in which the distance to the first operation portion (area G) is longer among the two pressure detectors”. The first press switch **141** is provided approximately in the center of a rear portion (a portion on the Y-axis negative side) of the upper surface **140**A. The second press switch **142** is provided near a front-left corner (corner of the Y-axis positive side and the X-axis negative side) on the upper surface **140**A. The light emitting elements **143-1** to **143-7** are mounted on the upper surface **140**A of the substrate **140**.

(37) The second housing **150** is a resin component arranged at the lowermost portion of the input device **100**. The second housing **150** includes a flat portion **151** and a peripheral wall portion **152**. The flat portion **151** is a planar portion parallel to the XY plane. The peripheral wall portion **152** is provided so as to project upward (in the positive Z-axis direction) of the upper surface of the flat portion **151**, and is a wall-shaped portion having a rectangular shape in a plan view seen from the top (in the positive Z-axis direction). In the second housing **150**, two pedestal portions **153** are aligned in a front-rear direction on the upper surface of the flat portion **151**, inside the peripheral wall portion **152**. The pedestal portion **153** has a cylindrical shape and supports the substrate **140** at a predetermined height from the lower side (on the Z-axis negative side). The second housing **150** is screwed and fixed to the first housing **130** by two fixing screws **154** penetrating the pedestal portions **153** while being coupled to the lower side of the first housing **130**.

(38) In the input device **100** configured as described above, the holder **120** and the operation panel **110** rock around the rocking axis AX so that the rear-right corner (corner of the X-axis positive side and the Y-axis negative side) of the holder **120** and the operation panel **110** moves toward the substrate **140** when any one of the areas A, B, or G of the operation panel **110** is pressed. Thus, the input device **100** can detect that when the first press switch **141** is pressed, any one of the areas A, B, or G is pressed.

(39) Further, in the input device **100**, the holder **120** and the operation panel **110** rock around the rocking axis AX so that the front-left corner (the corner of the X-axis negative side and the Y-axis positive side) of the holder **120** and the operation panel **110** moves toward the substrate **140** when either of the areas D or E of the operation panel **110** is pressed. Thus, the input device **100** can detect that either of the areas D or E is pressed when the second press switch **142** is pressed.

(40) Further, the input device **100** includes a restrainer **160** described in the following, so that when the area F of the operation panel **110** is pressed, the rocking of the holder **120** and the operation panel **110** is restrained, and the first press switch **141** and the second press switch **142** are not pressed.

(41) Further, the input device **100** includes the restrainer **160** described in the following, so that when the symbol display portion **115** of the operation panel **110** is pressed, the rocking of the holder **120** and the operation panel **110** is restrained, and the first press switch **141** and the second press switch **142** are not pressed.

(42) Therefore, when a misoperation is performed, the input device **100** can avoid detection of the misoperation.

(43) As illustrated in FIG. **3**, the area F is provided on the rocking axis AX. This makes it difficult for the input device **100** to rock the operation panel **110** and the holder **120** when a misoperation of pressing the area F is performed. Accordingly, it is possible to prevent the first press switch **141** and the second press switch **142** from being pressed by misoperation.

Configuration of the First Housing **130**

(44) FIG. **6** is a plan view of the first housing **130** provided in the input device **100** according to the embodiment. FIG. **7** is an external perspective view of the first housing **130** provided in the input device **100** according to the embodiment.

(45) As illustrated in FIGS. **6** and **7**, the first housing **130** includes a flat portion **131** parallel to the XY plane, and a wall-shaped frame **132** that is perpendicular to the XY plane and surrounding the

flat portion **131**. The first housing **130** also includes a pair of cylindrical lock portions **133** protruding in a direction of the rocking axis AX, on side surfaces of the frame **132**.
(46) Specifically, in the first housing **130**, a pair of support surfaces **132**A orthogonal to the rocking axis AX are formed at a side surface of the front-right corner (corner of the X-axis positive side and the Y-axis positive side) of the frame **132** and at an intermediate position in the front-rear direction (Y-axis direction) of the left side surface (side surface on the X-axis negative side) of the frame **132**. In the first housing **130**, the pair of cylindrical lock portions **133** projecting in the direction of the rocking axis AX are respectively provided on the pair of support surfaces **132**A. The pair of lock portions **133** have a cylindrical shape, are formed at edges of the first housing **130**, and are shaped to form the rocking axis AX.
(47) When the pair of lock portions **133** are fitted into the pair of bearing holes **122**A provided in the holder **120**, the holder **120** and the operation panel **110** are rockably engaged around the rocking axis AX. Since the pair of lock portions **133** rock around the rocking axis AX while contacting surfaces **122**Ac and **122**Ad, which will be described in detail in the following, the holder **120** and the operation panel **110** are held rockably in the direction (rocking direction) with the rocking axis AX as the rocking center.
(48) At the same time, each of the lock portions **133** respectively contacts the surfaces **122**Ac and **122**Ad, thereby restricting the holder **120** and the operation panel **110** from rotating in a rotation direction in which the Z-axis direction is a center axis. Further, the respective lock portions **133** can move upward (in the positive Z-axis direction) until they contact a surface **122**Aa, which will be described in detail in the following. Therefore, when there is no element other than the surface **122**Aa to prevent the shift, the lock portions **133** can move downward thereof (in the negative Z-axis direction) until they contact a surface **122**Ab.
(49) Further, the holder **120** and the operation panel **110** are supported by the two press switches (**141** and **142**) while their vertical movement limit positions are defined by the surface **122**Aa and the surface **122**Ab, and are caused to move upward thereof by a recovery force from the two press switches. In other words, the holder **120** and the operation panel **110** are restricted so as not to rotate only in the rotation direction in which with the Z-axis direction is the center axis, and at the same time, they are configured to be rockable in all other directions. As illustrated in FIG. **17**, in the present embodiment, since the projection **161-1** is provided in the vicinity of the area F, the projection **161-1** prevents the lock portion **133** provided in the vicinity of the area F from shifting downward thereof. Therefore, when the area F is pressed, the holder **120** and the operation panel **110** do not rock.
(50) Further, as illustrated in FIGS. **6** and **7**, two through-holes **134-1** and **134-2** having a circular shape in a plan view seen from the top are formed in the flat portion **131** of the first housing **130**.
(51) The through-hole **134-1** is formed, in a plan view seen from the top, at a position overlapping with the press portion **121-1** provided in the holder **120** and with the first press switch **141** mounted on the substrate **140**. The through-hole **134-1** enables the holder **120** and the operation panel **110** to rock (rocking in which the rear-right corner moves toward the substrate **140**) when any one of the areas A, B, or G of the operation panel **110** is pressed by penetration of the press portion **121-1** therethrough, and enables the press portion **121-1** to press the first press switch **141** by the rocking of the holder **120** and the operation panel **110**.
(52) The through-hole **134-2** is formed, in a plan view seen from the top, at a position overlapping with the press portion **121-2** provided in the holder **120** and with the second press switch **142** mounted on the substrate **140**. The through-hole **134-2** enables the holder **120** and the operation panel **110** to rock (rocking in which the front-left corner moves toward the substrate **140**) when either of the area D or the area E of the operation panel **110** is pressed by penetration of the press portion **121-2** therethrough, and enables the press portion **121-2** to press the second press switch **142** by the rocking of the holder **120** and the operation panel **110**.
(53) As illustrated in FIGS. **6** and **7**, the flat portion **131** of the first housing **130** includes two

recessed contact portions **162-1** and **162-2** having a circular shape in a plan view seen from the top.
(54) The contact portion **162-1** is included in the restrainer **160** and is formed, in a plan view seen from the top, at a position overlapping with an area on the front-right side (an area on the X-axis positive side and an area on the Y-axis positive side) of the flat portion **131** and with the projection **161-1** provided in the holder **120**. The contact portion **162-1** prevents the holder **120** and the operation panel **110** from rocking by contacting the projection **161-1** when the area F of the operation panel **110** is pressed, and prevents the first press switch **141** and the second press switch **142** from being pressed.
(55) The contact portion **162-2** is formed, in a plan view seen from the top, at a position overlapping with the projection **161-2** provided in the holder **120**, approximately in a center of the flat portion **131**. When the symbol display portion **115** of the operation panel **110** is pressed, the contact portion **162-2** prevents the holder **120** and the operation panel **110** from rocking by contacting the projection **161-2**, and prevents the first press switch **141** and the second press switch **142** from being pressed.
(56) As illustrated in FIGS. **6** and **7**, the flat portion **131** of the first housing **130** is provided with tubular portions **135-1** to **135-6** having a rectangular cylindrical shape and a rectangular opening **136**.
(57) The tubular portion **135-1** is provided, in a plan view seen from the top, at a position overlapping with the area A of the operation panel **110** and with the light-emitting element **143-1** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-1** to the area A to cause the display portion **113-1** in the area A to light up.
(58) The tubular portion **135-2** is provided, in a plan view seen from the top, at a position overlapping with the area B of the operation panel **110** and with the light-emitting element **143-2** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-2** to the area B to cause the display portion **113-2** in the area B to light up.
(59) The tubular portion **135-3** is provided, in a plan view seen from the top, at a position overlapping with the area D of the operation panel **110** and with the light-emitting element **143-3** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-3** to the area D to cause the display portion **113-3** in the area D to light up.
(60) The tubular portion **135-4** is provided, in a plan view seen from the top, at a position overlapping with the area E of the operation panel **110** and with the light-emitting element **143-4** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-4** to the area E to cause the display portion **113-4** in the area E to light up.
(61) The tubular portion **135-5** is provided, in a plan view seen from the top, at a position overlapping with the area G of the operation panel **110** and with the light-emitting element **143-5** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-5** to the area G to cause the display portion **113-5** in the area G to light up.
(62) The tubular portion **135-6** is provided, in a plan view seen from the top, at a position overlapping with the area F of the operation panel **110** and with the light-emitting element **143-6** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-6** to the area F to cause the display portion **114** in the area F to light up.
(63) The opening **136** is provided, in a plan view seen from the top, at a position overlapping with the symbol display portion **115** of the operation panel **110**, a tubular portion **123** of the holder **120**, and the light-emitting element **143-7** mounted on the substrate **140**, and directs light emitted from the light-emitting element **143-7** to the symbol display portion **115** via the tubular portion **123** of the holder **120** to cause the symbol display portion **115** to light up.
(64) An amount by which the tubular portions **135-1** to **135-6** can move in the vertical direction (Z-axis direction) when the operation panel **110** rocks is equal to or greater than an amount by which the press portions **121-1** and **121-2** can move in the vertical direction (Z-axis direction) when the operation panel **110** rocks. Thus, in the input device **100**, the movement of the tubular portions **135-**

1 to **135-6** in the vertical direction (Z-axis direction) when the operation panel **110** rocks does not interfere with the pressing on the first press switch **141** and the second press switch **142** by the press portions **121-1** and **121-2**.

Configuration of the Holder **120**

(65) FIGS. **8** and **9** are external perspective views of the operation panel **110**, the holder **120**, and the first housing **130** provided in the input device **100** according to the embodiment. FIG. **10** is a sectional perspective view taken along a section line I-I (see FIG. **3**) of the input device **100** according to the embodiment. FIG. **11** is a sectional perspective view taken along a section line II-II (see FIG. **3**) of the input device **100** according to the embodiment.

(66) As illustrated in FIG. **8**, the first housing **130** includes a pair of lock portions **133**. On the other hand, the holder **120** includes a pair of bearing portions **122** provided so as to hang down from a lower surface of the holder **120**. Each of the pair of bearing portions **122** includes the bearing hole **122**A in a vicinity of the lower end. As illustrated in FIG. **9**, when the first housing **130** is assembled to the holder **120**, each of the pair of lock portions **133** is fitted into a corresponding bearing hole **122**A of the pair of bearing holes **122**A.

(67) The holder **120** is supported in a state of being caused to move upward thereof (in the positive Z-axis direction) by the recovery force of the first press switch **141** and the second press switch **142**. As illustrated in FIGS. **14** and **16**, the bearing hole **122**A of the holder **120** includes surfaces **122**Aa to **122**Ad, and has a vertically elongated rectangular shape.

(68) The surface **122**Aa and the surface **122**Ab face each other. The surface **122**Aa defines a limit position when the holder **120** shifts downward thereof. The surface **122**Ab defines a limit position when the holder **120** shifts upward thereof. The surface **122**Ac and the surface **122**Ad face each other, and a distance therebetween is approximately the same as the size of the lock portion **133**.

(69) When the first housing **130** is assembled to the holder **120**, the holder **120** is caused to move upward thereof by the first press switch **141** and the second press switch **142**, so that the surface **122**Ab of the holder **120** and the lock portion **133** of the first housing **130** contact each other. For the same reason, the surface **122**Aa and the lock portion **133** are positioned apart from each other by a distance D**3** or a distance D**4**. As a result, the holder **120** and the operation panel **110** do not rotate around the Z-axis direction because movement of the lock portion **133** is restricted by the surface **122**Ac and the surface **122**Ad, and at the same time, are arranged to be rockable in all other directions.

(70) In other words, the holder **120** and the operation panel **110** are supported by the pair of lock portions **133** so as to be rockable around the rocking axis AX, and are supported so as to be vertically movable by the distance D**3** and the distance D**4**. For this reason, the holder **120** and the operation panel **110** can rock around the rocking axis AX in a range up to they are stopped by receiving a reaction force from the first press switch **141** or the second press switch **142**. In the present embodiment, the distance D**3** and the distance D**4** are set approximately the same as an operation stroke of when the two press switches (**141** and **142**) are pressed and turned on from a neutral state.

(71) The holder **120** and the operation panel **110** can rock in a direction parallel to the rocking axis AX and a plane parallel to the vertical direction (Z-axis direction) in a range until the lock portions **133** are restricted by the surface **122**Aa or the surface **122**Ab.

(72) The range in which the holder **120** and the operation panel **110** rock in the direction parallel to the rocking axis AX and the plane parallel to the vertical direction (Z-axis direction) is preferably set smaller than the switch stroke of when the second press switch **142** is pressed and turned on from the neutral state.

(73) The range in which the holder **120** and the operation panel **110** rock in the direction parallel to the rocking axis AX and the plane parallel to the vertical direction (Z-axis direction) is set smaller than the range in which the holder **120** and the operation panel **110** rock around the rocking axis AX.

(74) Further, as illustrated in FIG. **8**, the holder **120** is provided with the cylindrical projections **161-1** and **161-2** that extend downward of the lower surface of the holder **120**.
(75) Specifically, the projection **161-1** is included in the restrainer **160** and is provided in an area on the front-right side of the holder **120** (an area on the X-axis positive side and the Y-axis positive side) and at a position overlapping with the contact portion **162-1** of the first housing **130**, in a plan view seen from the top. As illustrated in FIGS. **6** and **7**, in a plan view seen from the top, the contact portion **162-1** is provided at a position overlapping with the rocking axis AX and at a position closer to the area F than the center of the pair of lock portions **133**. As illustrated in FIGS. **9** and **10**, when the first housing **130** is assembled to the holder **120**, the lower end surface of the projection **161-1** is positioned slightly apart from the upper side of the contact portion **162-1** of the first housing **130**. Thus, when the area F of the operation panel **110** is pressed, the projection **161-1** contacts the contact portion **162-1**, thereby restraining rocking of the holder **120** and the operation panel **110** and preventing the second press switch **142** from being pressed. As described above, the range in which the holder **120** and the operation panel **110** rock in the direction parallel to the rocking axis AX and the plane parallel to the vertical direction (Z-axis direction) is set smaller than ranges in which the holder **120** and the operation panel **110** rock in other directions, and under such conditions, the above-described restraining effect is generated. Therefore, when the area F of the operation panel **110** is pressed, the holder **120** and the operation panel **110** do not appreciably shift. Further, a touch feeling generated by the contact between the projection **161-1** and the contact portion **162-1** is fed back to a finger of an operator as a clear resistance. Therefore, the operator can sense from the operation touch feeling that the area F is an operation portion that does not correspond to the pressing. When the area E or the area G is pressed, the projection **161-1** does not contact the contact portion **162-1**, so that the rocking of the holder **120** and the operation panel **110** is not restrained.
(76) The projection **161-2** is included in the restrainer **160**. The projection **161-2** is provided approximately in the center of the holder **120** and, in a plan view from the top, at a position overlapping with the contact portion **162-2** of the first housing **130**. As illustrated in FIGS. **9** and **11**, when the first housing **130** is assembled to the holder **120**, the lower end surface of the projection **161-2** is positioned slightly apart from the upper side of the contact portion **162-2** of the first housing **130**. Thus, when the symbol display portion **115** of the operation panel **110** is pressed, the projection **161-2** contacts the contact portion **162-2** to restrain rocking of the holder **120** and the operation panel **110**, thereby preventing the first press switch **141** and the second press switch **142** from being pressed. Incidentally, when the area E is pressed, the projection **161-2** does not contact the contact portion **162-2**, so that the rocking of the holder **120** and the operation panel **110** is not restrained.
(77) Further, as illustrated in FIG. **8**, the holder **120** is provided with cylindrical press portions **121-1** and **121-2** that extend downward of the lower surface of the holder **120**.
(78) More specifically, the press portion **121-1** is provided approximately in the center in the left-right direction (X-axis direction) of the area on the rear side (Y-axis negative side) of the holder **120**, and at a position overlapping with the through-hole **134-1** of the first housing **130**, in a plan view seen from the top. As illustrated in FIG. **9**, when the first housing **130** is assembled to the holder **120**, the lower end surface of the press portion **121-1** is positioned slightly apart from the upper side of the first press switch **141** in a state penetrating through the through-hole **134-1**. Thus, when any one of the areas A, B, or G of the operation panel **110** is pressed, the press portion **121-1** can press the first press switch **141** by rocking of the holder **120** and the operation panel **110**.
(79) Furthermore, the press portion **121-2** is provided near the front-left corner (corner of the X-axis negative side and the Y-axis positive side) of the holder **120**, and at a position overlapping with the through-hole **134-2** of the first housing **130**, in a plan view seen from the top. As illustrated in FIG. **9**, when the first housing **130** is assembled to the holder **120**, the lower end surface of the press portion **121-2** is positioned slightly apart from the upper side of the second press switch **142**

in a state penetrating through the through-hole **134-2**. Thus, when either of the areas D or E of the operation panel **110** is pressed, the press portion **121-2** can press the second press switch **142** by rocking of the holder **120** and the operation panel **110**.

Guide

(80) FIG. **12** is a sectional perspective view of the input device **100** according to the embodiment taken along a section line III-III (see FIG. **4**).

(81) The input device **100** according to the embodiment includes a guide **170**. The guide **170** includes a pair of guide ribs **171** provided so as to extend downward of the lower surface of the holder **120**, and a pair of guide grooves **172** vertically projecting from the lower surface of the holder **120**. As illustrated in FIG. **12**, the guide **170** guides the movement of the holder **120** and the operation panel **110** in the vertical direction (X-axis direction) by engaging the pair of guide ribs **171** with the pair of guide grooves **172**.

(82) As illustrated in FIG. **12**, a line L**1** connecting the pair of guide ribs **171** is approximately orthogonal to the rocking axis AX. Thus, the input device **100** according to the embodiment can guide rocking of the holder **120** and the operation panel **110** around the rocking axis AX, and can lock the tilt of the rocking axis AX of the holder **120** and the operation panel **110** in the axial direction.

Configuration of the Bearing Holes **122**A

(83) FIG. **13** is a sectional perspective view of an input device **100** according to the embodiment taken along a sectional line IV-IV (see FIG. **3**). As illustrated in FIG. **13**, the lock portion **133** of the first housing **130** is fitted into the bearing hole **122**A of the holder **120**, thereby locking the holder **120** and the operation panel **110** so as to be rockable about the rocking axis AX. The lock portion **133** is included in the restrainer **160**.

(84) Here, as illustrated in FIG. **13**, the lateral width of the bearing hole **122**A is approximately the diameter of the lock portion **133**, but a vertical width thereof is slightly larger than the diameter of the lock portion **133**. Therefore, the bearing hole **122**A can move slightly in the vertical direction (Z-axis direction) within the bearing hole **122**A. Thus, the input device **100** according to the embodiment can move slightly in the vertical direction (Z-axis direction) to such an extent that the holder **120** and the operation panel **110** do not press the first press switch **141** and the second press switch **142** relative to the first housing **130**.

(85) FIG. **17** is a diagram illustrating a positional relationship between the rocking axis AX, the area E, the area G, the area F, the first press switch **141** and the second press switch **142**, and the projection **161-1** in the input device **100** according to the embodiment.

(86) In the input device **100** according to the embodiment, the rocking axis AX connecting the two lock portions **133** intersects with a line connecting the area E and the first press switch **141** in a plan view seen from the top. The rocking axis AX also intersects with a line connecting the area G and the second press switch **142**. In other words, in a plan view seen from the top, the rocking axis AX intersects with the line connecting the first operation portion **113** and the first press switch **141** or the second press switch **142** whichever having a longer distance to the first operation portion **113**.

(87) When the area E of the operation panel **110** is pressed, the operation panel **110** rocks around a vertex, as a fulcrum, of the first press switch **141** that has a longer distance to the area E among the two press switches **141** and **142** in a plan view seen from the top. At this time, the second press switch **142** is pressed by the holder **120**, and a signal related to pressing detection is generated.

(88) When the area G of the operation panel **110** is pressed, the operation panel **110** rocks around the vertex, as a fulcrum, of the second press switch **142** that has a longer distance to the area G among the two press switches **141** and **142** in a plan view seen from the top. At this time, the first press switch **141** is pressed by the holder **120**, and a signal related to pressing detection is generated.

(89) Further, in the example as illustrated in FIG. **17**, the rocking axis AX intersects with a line L**2**

that connects the area E and the first press switch **141** having a longer distance to the area E.
(90) As illustrated in FIG. **17**, in the input device **100** according to the embodiment, the projection **161-1** is provided at a position overlapping with the rocking axis AX in a plan view seen from the top.
(91) Thus, the input device **100** according to the embodiment can enhance the effect of restraining pressing on the first press switch **141** and the second press switch **142** when the area F is pressed.
(92) Furthermore, as illustrated in FIG. **17**, in the input device **100** according to the embodiment, a distance D**1** between the projection **161-1** and the first press switch **141** that has a longer distance to the area F among the first press switch **141** and the second press switch **142**, is longer than a distance D**2** that is a distance between the projection **161-1** and the area F, in a plan view seen from the top.
(93) Thus, the input device **100** according to the embodiment can further enhance the effect of restraining the rocking of the operation panel **110** caused by pressing in the area F and the effect of not restraining the rocking of the operation panel **110** caused by pressing in the area E.
(94) In other words, when the area F is pressed, the operation panel **110** rocks around the vertex, as a fulcrum, of the first press switch **141** that has the longer distance to the area F among the two press switches (**141** and **142**) in a plan view seen from the top (in the positive Z-axis direction). However, since the projection **161-1** restrains rocking of the operation panel **110**, the second press switch **142**, that has a shorter distance to the area F, does not detect pressing in the area F.
Effects
(95) As described above, the input device **100** according to the embodiment includes a housing, the operation panel **110** including an operation portion configured to receive touching and pressing from an operator and being supported rockably relative to the housing, the substrate **140** housed in the housing, an electrostatic detection electrode for detecting touching, and the first press switch **141** and the second press switch **142** for detecting pressing. The operation portion includes a first operation portion (areas E and G) that receives touching and pressing, a second operation portion (area F) that receives only touching, and the restrainer **160** configured to differentiate operation that moves the operation panel **110** toward the substrate **140** upon pressing on the first operation portion (areas E and G) from operation that moves the operation panel **110** toward the substrate **140** upon pressing on the second operation portion (area F).
(96) Thus, in the input device **100** according to the embodiment, when the second operation portion (area F) is pressed mistakenly, the operation in which the operation panel **110** moves toward the substrate **140** differs from the operation when the first operation portion (areas E and G) is pressed. Accordingly, an operator can recognize that the second operation portion (area F) is pressed mistakenly due to the difference in the operation. Therefore, according to the input device **100** according to the embodiment, misoperation of the first press switch **141** and the second press switch **142** can be reduced.
(97) Furthermore, in the input device **100** according to the embodiment, the restrainer **160** includes the projection **161-1** extending from the operation panel **110** toward the housing. The projection **161-1** contacts the contact portion **162-1** of the housing when the second operation portion (area F) is pressed to restrain rocking of the operation panel **110**, but does not restrain rocking of the operation panel **110** when the first operation portion (areas E and G) is pressed.
(98) Thus, the input device **100** according to the embodiment does not impede rocking of the operation panel **110** when a normal operation is performed on the first operation portion (areas E and G) and restrains rocking of the operation panel **110** when the second operation portion (area F) is operated mistakenly.
(99) The input device according to one embodiment is capable of reducing misoperation of the pressure detector.
(100) Although one embodiment of the present invention has been described in detail above, the

present invention is not limited to the embodiment, and various modifications or modifications are possible within the scope of the gist of the invention described in the claims.

Claims

1. An input device, comprising: a housing; an operation panel that includes an operation portion configured to receive touching and pressing from an operator, and is supported so as to be rockable relative to the housing; a substrate that is housed in the housing; an electrostatic detection electrode configured to detect the touching; and a pressure detector configured to detect the pressing, wherein the operation portion includes a first operation portion configured to receive both of the touching and the pressing, and a second operation portion configured to receive only the touching without receiving the pressing, and the input device includes a restrainer configured to differentiate operation that moves the operation panel toward the substrate upon pressing on the first operation portion from operation that moves the operation panel toward the substrate upon pressing on the second operation portion, wherein the restrainer includes: a projection extending from the operation panel toward the housing and a contact portion that is provided in the housing and configured to contact the projection, or a projection extending from the housing toward the operation panel and a contact portion that is provided in the operation panel and configured to contact the projection, and upon pressing on the first operation portion, the restrainer is provided so as not to restrain rocking of the operation panel by the projection not contacting the contact portion, and upon pressing on the second operation portion, the restrainer is provided so as to restrain rocking of the operation panel by the projection contacting the contact portion, wherein the input device further comprises: two pressure detectors each being the pressure detector, wherein upon pressing on the first operation portion, the operation panel rocks around one pressure detector of the two pressure detectors, the one pressure detector serving as a fulcrum and having a longer distance to the first operation portion in a plan view seen from a direction perpendicular to the substrate, and the pressing on the first operation portion is detected by another pressure detector of the two pressure detectors, the another pressure detector having a shorter distance to the first operation portion, and wherein in the plan view seen from the direction perpendicular to the substrate, a distance between the projection and one pressure detector of the two pressure detectors, the one pressure detector having a longer distance to the second operation portion, is set longer than a distance between the projection and the second operation portion, and upon pressing on the second operation portion, the operation panel rocks around the one pressure detector of the two pressure detectors serving as a fulcrum and having the longer distance to the second operation portion in the plan view seen from the direction perpendicular to the substrate, and the rocking of the operation panel is restrained by the projection and the pressing on the second operation portion is not detected by another pressure detector of the two pressure detectors, the another pressure detector having a shorter distance to the second operation portion.
2. The input device according to claim 1, wherein the restrainer includes two lock portions provided in the housing, the two lock portions being configured as a pair to define only a rocking direction of the operation panel by supporting both ends of a rocking axis serving as a rocking center, and lock the operation panel so as to be movable in other directions, in the plan view seen from the direction perpendicular to the substrate, the rocking axis intersects with a line that connects the first operation portion and one pressure detector of the two pressure detectors, the one pressure detector having a longer distance to the first operation portion, and in the plan view seen from the direction perpendicular to the substrate, the projection is provided at a position overlapping with the rocking axis.
3. The input device according to claim 1, wherein the restrainer includes two lock portions provided in the housing, the two lock portions being configured as a pair to define only a rocking direction of the operation panel by supporting both ends of a rocking axis serving as a rocking

center, and lock the operation panel so as to be movable in other directions, in the plan view seen from the direction perpendicular to the substrate, the rocking axis intersects with a line that connects the first operation portion and one pressure detector of the two pressure detectors, the one pressure detector having a longer distance to the first operation portion, and in the plan view seen from the direction perpendicular to the substrate, the projection is provided at a position overlapping with the rocking axis.

4. The input device according to claim 2, wherein in the plan view seen from the direction perpendicular to the substrate, the second operation portion is provided at the position overlapping with the rocking axis.

5. The input device according to claim 3, wherein in the plan view seen from the direction perpendicular to the substrate, the second operation portion is provided at the position overlapping with the rocking axis.

6. The input device according to claim 1, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.

7. The input device according to claim 1, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.

8. The input device according to claim 1, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.

9. The input device according to claim 2, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.

10. The input device according to claim 3, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.

11. The input device according to claim 4, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.

12. The input device according to claim 5, wherein the housing is provided so as to cover the substrate, and rockably supports the operation panel.