

# US Patent & Trademark Office

## Patent Public Search | Text View

---

United States Patent Application Publication

20250256759

Kind Code

A1

Publication Date

August 14, 2025

Inventor(s)

SEKI; Kodai et al.

---

### STEERING DEVICE

---

#### Abstract

A steering device includes a first steering column arranged outside a steering shaft, and a second steering column arranged outside the first steering column and movable relative to the first steering column in a first direction. The first steering column includes a pin extending in a second direction intersecting the first direction. The second steering column includes a projection arranged on one side in the first direction of the pin and capable of abutting on the pin to prevent movement of the first steering column.

---

**Inventors:** SEKI; Kodai (Gunma, JP), MATSUDA; Yasuyuki (Gunma, JP)

**Applicant:** NSK STEERING & CONTROL, INC. (Tokyo, JP)

**Family ID:** 88918855

**Assignee:** NSK STEERING & CONTROL, INC. (Tokyo, JP)

**Appl. No.:** 18/857061

**Filed (or PCT Filed):** December 15, 2022

**PCT No.:** PCT/JP2022/046204

#### Foreign Application Priority Data

JP	2022-083948	May. 23, 2022
----	-------------	---------------

---

#### Publication Classification

**Int. Cl.:** B62D1/185 (20060101); B62D1/181 (20060101)

**U.S. Cl.:**

**CPC** B62D1/185 (20130101); B62D1/181 (20130101);

---

# Background/Summary

## FIELD

[0001] The present disclosure relates to a steering device.

## BACKGROUND

[0002] A retractable steering device disclosed in Patent Literature 1 is known. In the retractable steering device, an extendable steering column is contracted in an axial direction to store a steering wheel in, for example, a dashboard. The steering column extends and contracts in the axial direction by connecting a plurality of steering columns. The retractable steering device includes, for example, a first steering column provided outside a steering shaft to which a steering wheel is connected, a second steering column provided outside the first steering column, and an actuator device that changes an axial distance between the first steering column and the second steering column.

[0003] The actuator device includes a ball screw having a screw shaft and a nut, and a motor. One side in the axial direction of the screw shaft is provided on the first steering column, and the nut is engaged with the other side in the axial direction of the screw shaft, so that the nut is provided on the second steering column. When the motor is operated and rotated, the screw shaft rotates, and the nut moves in the axial direction relative to the screw shaft. As a result, the second steering column moves in the axial direction with respect to the first steering column.

[0004] Here, when the axial position of the second steering column comes to a predetermined position with respect to the first steering column, the motor stops and the movement of the second steering column stops. However, for example, when the motor fails and the second steering column does not stop at the predetermined position, the second steering column may fall off the first steering column.

[0005] In order to prevent this falling off, in Patent Literature 1, a protrusion having a diameter larger than that of a male threaded portion of the threaded shaft and capable of abutting on the nut is provided at the tip of the threaded shaft. When the nut abuts on the protrusion, the rotation of the nut is stopped, and the nut is prevented from coming off from the tip of the screw shaft. This prevents the second steering column from falling off the first steering column.

## CITATION LIST

Patent Literature

[0006] Patent Literature 1: U.S. Pat. No. 10,882,548

## SUMMARY

### Technical Problem

[0007] In Patent Literature 1, since a protrusion for restricting the movement of the nut is provided at the tip of the screw shaft, the overall length of the screw shaft becomes long. In order to shorten the length of the screw shaft, it is necessary to shorten (thin) the axial length of the protrusion. However, in a case where the protrusion is thinned, when the nut and the protrusion abut on each other, the protrusion is deformed, the movement of the nut cannot be restricted, and the steering column may fall off. That is, there is a demand for a steering device that can more reliably prevent the steering column from falling off without increasing the overall length of the screw shaft.

[0008] The present disclosure has been made in view of the above problem, and an object of the present disclosure is to provide a steering device that can more reliably prevent a steering column from falling off without increasing the overall length of a screw shaft.

### Solution to Problem

[0009] To achieve the above object, a steering device according to an aspect of the present disclosure comprising: a steering shaft extending in a first direction and having a steering wheel coupled to an end portion on one side in the first direction; a first steering column arranged outside

the steering shaft; and a second steering column arranged outside the first steering column and is movable relative to the first steering column in the first direction via a first actuator device, wherein the first steering column includes a pin extending in a second direction intersecting the first direction, and the second steering column includes a projection arranged on one side in the first direction of the pin and capable of abutting on the pin.

[0010] As described above, in Patent Literature 1, since the protrusion for restricting the movement of the nut is provided at the tip of the screw shaft, the overall length of the screw shaft becomes long. Therefore, there is a demand for a steering device that can more reliably prevent a steering column from falling off without increasing the overall length of a screw shaft.

[0011] Against this background, in the present disclosure, a pin provided in a first steering column and extending in a second direction is provided. The pin abuts on a projection of a second steering column, and it is possible to prevent the second steering column from falling off from the first steering column. As described above, according to the present disclosure, it is possible to provide the steering device that can more reliably prevent the steering column from falling off without increasing the overall length of the screw shaft.

[0012] In another aspect of the present disclosure, since the projection protrudes in a third direction intersecting a first direction and the second direction, the pin easily abuts on the projection, and the steering column can be more reliably prevented from falling off.

[0013] In another aspect of the present disclosure, the projection is provided with a cutout portion on the other side in the first direction, and the pin can abut on the cutout portion. In this manner, since the pin abuts on the cutout portion, the position of the pin is less likely to deviate from the cutout portion, and the second steering column can be more reliably prevented from falling off from the first steering column.

[0014] In another aspect of the present disclosure, the projection is a plate-shaped member having a rectangular shape when viewed from the second direction, and the cutout portion is provided at a corner between a side on the other side in the first direction and a side on one side in the third direction in the plate-shaped member. In other words, since the projection is a plate-like member extending in the first direction, the rigidity of the projection regarding force toward the first direction becomes larger, and it is possible to more reliably prevent the second steering column from falling off from the first steering column.

[0015] In another aspect of the present disclosure, a third steering column extending along the first direction is provided between the steering shaft and the first steering column; the third steering column is movable relative to the first steering column in the first direction via a second actuator device; and the second actuator device is attached to the first steering column via the pin. In other words, since the pin is attached to the second actuator device and the first steering column, the attachment rigidity of the pin is further improved. Therefore, the pin is less likely to be damaged, and the second steering column can be more reliably prevented from falling off from the first steering column.

[0016] In another aspect of the present disclosure, a through hole penetrating in a second direction is provided in an attachment portion of the second actuator device to the first steering column; the first steering column has a flange protruding to one side in a third direction, the flange being provided with a through hole penetrating in the second direction; and the pin penetrates the through hole of the attachment portion and the through hole of the flange, and the second actuator device is attached to the first steering column. Therefore, since the attachment rigidity of the pin is further improved, the pin is even less likely to be damaged, and the second steering column can be more reliably prevented from falling off from the first steering column.

[0017] A steering device according to an aspect of the present disclosure comprising: a steering shaft extending in a first direction and having a steering wheel coupled to an end portion on one side in the first direction; a first steering column arranged outside the steering shaft; a second steering column arranged outside the first steering column and is movable relative to the first

steering column in the first direction; and a third steering column arranged between the steering shaft and the first steering column and extending along the first direction, wherein the third steering column is movable relative to the first steering column in the first direction via an actuator device including a motor and a gear box, and the second steering column includes a frame portion that is arranged on one side in the first direction of the motor and the gear box and is capable of abutting on the motor or the gear box.

[0018] Therefore, the frame portion can abut on the motor or the gear box of the first actuator device. The frame portion and the motor or the gear box can easily have higher rigidity than the above-described pin and plate-like member. Therefore, damage to the frame portion and the motor or the gear box is further reduced, and the second steering column can be more reliably prevented from falling off from the first steering column. Note that this also makes it possible to provide a steering device that can more reliably prevent a steering column from falling off without increasing the overall length of a screw shaft.

#### Advantageous Effects of Invention

[0019] According to the steering device of the present disclosure, it is possible to provide the steering device that can more reliably prevent the steering column from falling off without increasing the overall length of the screw shaft.

---

## Description

### BRIEF DESCRIPTION OF DRAWINGS

[0020] FIG. 1 is a perspective view of a steering device of a first embodiment.

[0021] FIG. 2 is a perspective view of the steering device of the first embodiment, illustrating a state in which a pin and a projection are separated from each other.

[0022] FIG. 3 is a perspective view of the steering device of the first embodiment, illustrating a state in which a second actuator device is assembled.

[0023] FIG. 4 is a perspective view of the steering device of the first embodiment, illustrating a state in which the pin and the projection are in contact with each other.

[0024] FIG. 5 is a perspective view of a steering device of a second embodiment.

[0025] FIG. 6 is a side view of the steering device of the second embodiment.

[0026] FIG. 7 is a cross-sectional view taken along line VII-VII of FIG. 6.

### DESCRIPTION OF EMBODIMENTS

[0027] Hereinafter, the present invention will be described in detail with reference to the drawings. Note that the present invention is not limited by the following modes for carrying out the invention (hereinafter referred to as embodiments). In addition, constituent elements in the following embodiments include those that can be easily assumed by those skilled in the art, those that are substantially the same, and those within a so-called equivalent range. Furthermore, the constituent elements disclosed in the following embodiments can be appropriately combined. In addition, constituent elements having the same configuration are denoted by the same reference numerals, and the description thereof will be omitted.

[0028] Note that in the XYZ orthogonal coordinates, the Y direction is orthogonal to (intersects) the X direction. The Z direction is orthogonal to (intersects) the X direction and the Y direction. The X1 side is opposite to the X2 side, the Y1 side is opposite to the Y2 side, and the Z1 side is opposite to the Z2 side. In the following description, the X direction corresponds to a first direction, the Z direction corresponds to a second direction, and the Y direction corresponds to a third direction. The X2 side is one side in the first direction, the X1 side is the other side in the first direction, the Z1 side is one side in the second direction, the Z2 side is the other side in the second direction, the Y1 side is one side in the third direction, and the Y2 side is the other side in the third direction.

## First Embodiment

[0029] FIG. 1 is a perspective view of a steering device of a first embodiment. FIG. 2 is a perspective view of the steering device of the first embodiment, illustrating a state in which a pin and a projection are separated from each other. FIG. 3 is a perspective view of the steering device according to the first embodiment, illustrating a state in which a second actuator device is assembled.

[0030] In the first embodiment, a steering device **100** is, for example, a retractable steering device. In the retractable steering device, when the vehicle is not driven, an extendable steering column can be contracted in the axial direction to store a steering wheel in, for example, a dashboard. Moreover, when the vehicle is driven, the steering column can be extended in the axial direction, and the steering wheel can protrude from the inside of the dashboard into the vehicle interior, for example. Details will be described below.

[0031] As illustrated in FIGS. 1 to 3, the steering device **100** includes a steering shaft **1**, an inner column **2** (third steering column), an intermediate column **3** (first steering column), an outer column **4** (second steering column), a first actuator unit **113**, and a second actuator unit **5**.

[0032] As illustrated in FIGS. 1 to 3, a steering wheel **105** is coupled to an end portion of the steering shaft **1** on the X2 side. The end portion on the X2 side is also referred to as a rear end portion or an end portion on one side in the first direction. Then, when the driver operates the steering wheel **105**, the steering shaft **1** rotates about a first central axis AX1, and an operation torque is applied to the steering shaft **1**. In this manner, the steering shaft **1** is coupled to the steering wheel **105** and extends in the X direction (first direction, axial direction).

[0033] The steering shaft **1** is inserted into the inner periphery of the inner column **2**. In other words, the cylindrical inner column **2** is arranged outside the steering shaft **1**. The inner column **2** is also referred to as a third steering column. The inner column **2** is connected to the steering shaft **1** via a torsion bar (not illustrated).

[0034] The inner column **2** is inserted inside the intermediate column **3**. In other words, the cylindrical intermediate column **3** is arranged outside the inner column **2**. The intermediate column **3** is also referred to as a first steering column. The inner column **2** and the intermediate column **3** can move relative to each other along the X direction via the second actuator unit **5**. The second actuator unit **5** extends in the X direction (first direction) which is the axial direction of a second central axis AX2. The second actuator unit **5** couples the inner column **2** to the intermediate column **3** and changes the axial distance between the inner column **2** and the intermediate column **3**.

[0035] The cylindrical intermediate column **3** is arranged outside the inner column **2**, and an open portion **33** is provided on a side portion thereof. The intermediate column **3** is provided with a flat portion **31** and a curved portion **32**. The flat portion **31** is a plane extending in the X direction and the Z direction. The open portion **33** has a rectangular shape when viewed from the Y direction. Specifically, an inner peripheral wall portion **34** facing the open portion **33** has a rectangular shape elongated along the X direction.

[0036] A flange **35** protruding toward the Y1 side is provided at an end portion on the X1 side of the flat portion **31**. One flange **35** is provided on each of the Z1 side and the Z2 side. The two flanges **35** are provided with through holes **351**. A pin **36** is inserted into the through hole **351**. The pin **36** extends in the Z direction.

[0037] A bracket **60** is fixed to the outer periphery of the inner column **2**. The bracket **60** is provided with a cutout portion **61**. The cutout portion **61** is open on the Y1 side. The bracket **60** can move inside the open portion **33** along the X direction. When the bracket **60** abuts on an end portion of the inner peripheral wall portion **34** on the X2 side, the movement of the inner column **2** on the X2 side with respect to the intermediate column **3** is prevented, whereby the inner column **2** is prevented from coming off from the intermediate column **3**.

[0038] Additionally, the second actuator unit **5** includes a second actuator device **50**, the bracket **60**, and the flange **35**. The second actuator device **50** includes a motor **51**, a gear box **52**, a screw shaft

**53**, and a nut **62**.

[0039] In the second actuator device **50**, a male screw is formed on the outer periphery of the screw shaft **53**. The screw shaft **53** extends in the X direction (first direction) which is the axial direction of the second central axis AX2. A female screw is formed on the inner periphery of the nut **62**, and the female screw meshes with the male screw of the screw shaft **53**. The nut **62** has a protrusion **63** protruding in the Z direction. The protrusion **63** of the nut **62** is fitted into the cutout portion **61** of the bracket **60**. In this manner, the X2 side of the second actuator device **50** is fixed to the inner column **2** via the nut **62** and the bracket **60**.

[0040] The X1 side of the screw shaft **53** is attached to the intermediate column **3** via the gear box **52**, the pin **36**, and the flange **35**. Hereinafter, a specific description will be given. The gear box **52** is attached to the screw shaft **53** on the X1 side. A worm shaft (not illustrated) of the motor **51** and a worm wheel (not illustrated) attached to the screw shaft **53** are housed inside the gear box **52**, and the worm shaft and the worm wheel are meshed with each other. That is, the gear box **52** houses a worm gear mechanism in which a worm shaft provided on the output shaft of the motor **51** and a worm wheel provided on the screw shaft **53** mesh with each other. When the motor **51** rotates by the worm gear mechanism, the screw shaft **53** rotates via the worm shaft and the worm wheel. As illustrated in FIGS. **2** and **4**, the gear box **52** is attached to the screw shaft **53** on the X1 side. The gear box **52** has a protruding portion **521** (attachment portion). The protruding portion **521** is provided with a through hole **522** penetrating in the Z direction. The pin **36** penetrates the through hole **351** of the flange **35** and the through hole **522** of the protruding portion **521**. As described above, the protruding portion **521** of the second actuator device **50** is an attachment portion for attaching the second actuator device **50** to the intermediate column **3**. Then, as illustrated in FIG. **2**, a tip portion **36a** of the pin **36** protrudes toward the **21** side from the flange **35**. A snap ring **37** is fitted to the tip portion **36a** of the pin **36**. The snap ring **37** has an effect of retaining the pin **36**. As a result, the protruding portion **521** (attachment portion) of the second actuator device **50** is attached to the flange **35** via the pin **36**.

[0041] According to the second actuator unit **5** having the above configuration, the motor **51** is operated and rotated, and the worm wheel also rotates when the worm shaft rotates inside the gear box **52**. Then, since the screw shaft **53** rotates together with the worm wheel, the nut **62** meshed with the screw shaft **53** moves in the axial direction (X direction, first direction) with respect to the screw shaft **53**. As a result, the relative distance between the nut **62** and the gear box **52** along the X direction changes. Therefore, the inner column **2** can move relative to the intermediate column **3** in the X direction via the second actuator unit **5**.

[0042] The intermediate column **3** is arranged inside the outer column **4**. In other words, the outer column **4** is arranged outside the intermediate column **3**. The outer column **4** is also referred to as a second steering column. The outer column **4** includes a main body portion **41** and a projection **7**. In the present embodiment, a plate-shaped member **70** is applied as an example of the projection **7**.

[0043] The side of the main body portion **41** on the Y1 side is open. That is, the main body portion **41** extends in an arc shape along the circumferential direction around the axis of the first central axis AX1 and has a substantially U-shaped cross section. In the main body portion **41**, one end portion in the circumferential direction is a first circumferential end portion **411**, and the other end portion in the circumferential direction is a second circumferential end portion **412**. An opening **42** is formed between the first circumferential end portion **411** and the second circumferential end portion **412**. That is, the main body portion **41** has a substantially U-shaped cross section open on the Y1 side. Additionally, an annular member **43** having an annular shape is attached to an end portion of the main body portion **41** on the X1 side. Each of the first circumferential end portion **411** and the second circumferential end portion **412** extends linearly along the X direction. The first circumferential end portion **411** and the second circumferential end portion **412** are substantially parallel. The first circumferential end portion **411** and the second circumferential end portion **412** are separated in the Z direction. The first circumferential end portion **411** is located on the z1 side,

and the second circumferential end portion **412** is located on the Z2 side. The plate-shaped member **70** is provided at a portion of the second circumferential end portion **412** on the X2 side. The plate-shaped member **70** protrudes toward the Y1 side. The plate-shaped member **70** has a substantially rectangular shape when viewed from the Z direction, and has an end surface (side) **72** on the Y1 side, an end surface (side) **73** on the X1 side, and an end surface (side) **74** on the X2 side. The end surface (side) **73** and the end surface (side) **74** extend substantially in parallel along the Y direction. An arc-shaped cutout portion **71** is provided at a corner between the end surface (side) **72** and the end surface (side) **73** when viewed from the Z direction. The cutout portion **71** is recessed toward the end surface (side) **74**. The pin **36** can abut on the cutout portion **71**.

[0044] The intermediate column **3** and the outer column **4** can move relative to each other along the X direction via the first actuator unit **113**. The first actuator unit **113** extends in the X direction (first direction) which is the axial direction of a third central axis AX3. The first actuator unit **113** includes a first actuator device **112**, a bracket **64**, and a flange **114**. The first actuator device **112** includes a motor **106**, a gear box **107**, a screw shaft **108**, and a nut **67**. The gear box **107** is attached to the outer column **4**. The gear box **107** houses a worm gear mechanism in which a worm shaft provided on the output shaft of the motor **106** meshes with a worm wheel provided on the screw shaft **108**. When the motor **106** is rotated by the worm gear mechanism, the screw shaft **108** rotates via the worm shaft and the worm wheel. The gear box **107** is attached to the screw shaft **108** on the X1 side. The nut **67** is attached to the screw shaft **108** on the X2 side. The nut **67** has a protrusion **68** protruding in the Y direction. The bracket **64** is fixed to the outer periphery of the intermediate column **3**. The bracket **64** is provided with a cutout portion **66**. The cutout portion **66** is open on the Z2 side. The protrusion **68** of the nut **67** is fitted into the cutout portion **66** of the bracket **64**.

[0045] According to the first actuator unit **113** having the above configuration, when the motor **106** operates and the worm shaft rotates, the worm wheel also rotates. Then, since the screw shaft **108** rotates together with the worm wheel, the nut **67** meshed with the screw shaft **108** moves in the axial direction (X direction, first direction). As a result, the relative distance between the nut **67** and the gear box **107** along the X direction changes. Therefore, the intermediate column **3** can move relative to the outer column **4** in the X direction via the first actuator unit **113**.

[0046] Note that the outer column **4** is provided with a gear box **101**, an electric motor **102**, and an ECU**104**. A worm shaft and a worm wheel of the electric motor **102** are housed inside the gear box **101**, and the worm shaft and the worm wheel mesh with each other. The ECU**104** controls the operation of the electric motor **102**. An auxiliary torque is applied to the steering shaft **1** by the ECU**104** and the electric motor **102**. That is, the steering device **100** of the present embodiment is an electric power steering device that assists the driver's steering with the electric motor **102**.

[0047] Note that an attachment member **110** is provided on the Z1 side of the outer column **4**. The attachment member **110** is provided with four attachment portions **111**, and the attachment member **110** is attached to the vehicle body via the four attachment portions **111**.

[0048] Next, the movement of the pin **36** when the intermediate column **3** moves in the X direction with respect to the outer column **4** will be described. FIG. **4** is a perspective view of the steering device according to the first embodiment, illustrating a state in which the pin and the projection are in contact with each other.

[0049] As described above, the steering device **100** is a retractable steering device, and axially contracts an extendable steering column to store the steering wheel **105** in, for example, a dashboard. When the steering column is extended and the steering wheel **105** is moved from the dashboard toward the vehicle rear side (X2 side), the first actuator unit **113** and the second actuator unit **5** are operated to move the inner column **2** and the intermediate column **3** toward the X2 side. For example, as described above, the inner column **2** can move relative to the intermediate column **3** in the X direction via the second actuator unit **5**. Additionally, the intermediate column **3** can move relative to the outer column **4** in the X direction via the first actuator unit **113**.

[0050] For example, as illustrated in FIG. **2**, when the position of the intermediate column **3** in the

X direction with respect to the outer column **4** reaches a predetermined position, the rotation of the motor **51** of the second actuator unit **5** stops. However, when the rotation of the motor **51** does not stop at the predetermined position due to some abnormality or the like, the intermediate column **3** moves further to the X2 side with respect to the outer column **4** from the state of FIG. **2**.

[0051] In this case, as illustrated in FIG. **4**, the pin **36** abuts on the cutout portion **71** of the plate-shaped member **70**. As a result, the intermediate column **3** is prevented from moving in the X direction with respect to the outer column **4**, and the outer column **4** is prevented from falling off from the intermediate column **3**.

[0052] As described above, the steering device **100** according to the first embodiment includes the steering shaft **1** extending in the X direction and having the steering wheel **105** coupled to the end portion on the X2 side, the intermediate column **3** (first steering column) arranged outside the steering shaft **1**, and the outer column **4** (second steering column) arranged outside the intermediate column **3** (first steering column) and movable relative to the intermediate column **3** (first steering column) in the X direction via the first actuator unit **113**. The intermediate column **3** (first steering column) has the pin **36** extending in the Z direction, and the outer column **4** (second steering column) has the projection **7** disposed on the X2 side of the pin **36** and capable of abutting on the pin **36**.

[0053] As described above, in Patent Literature 1, since the protrusion for restricting the movement of the nut is provided at the tip of the screw shaft, the overall length of the screw shaft becomes long. Therefore, there is a demand for a steering device that can more reliably prevent a steering column from falling off without increasing the overall length of a screw shaft.

[0054] On the other hand, in the present embodiment, the pin **36** provided in the intermediate column **3** (first steering column) and extending in the Z direction is provided. The pin **36** abuts on the projection **7** of the outer column **4**, and it is possible to prevent the outer column **4** (second steering column) from falling off the intermediate column **3** (first steering column). As described above, according to the first embodiment, it is possible to provide the steering device **100** that can more reliably prevent the outer column **4** (second steering column) from falling off without increasing the overall length of the screw shaft **53**.

[0055] Additionally, the projection **7** is provided with the cutout portion **71** on the X1 side, and the pin **36** can abut on the cutout portion **71**. In this manner, since the pin **36** abuts on the cutout portion **71**, the position of the pin **36** is less likely to deviate from the cutout portion **71**.

[0056] Furthermore, the projection **7** is the plate-shaped member **70** having a rectangular shape when viewed from the Z direction, and the cutout portion **71** is provided at a corner between the end surface (side) **72** on the Y1 side and the end surface (side) **73** on the X1 side in the plate-shaped member **70**. In other words, since the projection **7** is a plate-like member extending in the X direction, the rigidity of the projection **7** regarding force in the X direction becomes larger, and the outer column **4** can be more reliably prevented from falling off from the intermediate column **3**.

[0057] Moreover, the inner column **2** (third steering column) extending along the X direction is provided between the steering shaft **1** and the intermediate column **3** (first steering column), the inner column **2** is movable relative to the intermediate column in the first direction via a second actuator device, and the second actuator device **50** is attached to the intermediate column **3** via the pin **36**. In other words, since the pin **36** is attached to the second actuator device **50** and the intermediate column **3**, the attachment rigidity of the pin **36** is further improved. Therefore, the pin **36** is less likely to be damaged, and the outer column **4** can be more reliably prevented from falling off from the intermediate column **3**.

[0058] Note that the intermediate column **3** (first steering column) has the flange **35** protruding toward the Y1 side, and the flange **35** is provided with the through hole **351** penetrating in the Z direction. The protruding portion **521** (attachment portion) of the second actuator device **50** is provided with the through hole **522** penetrating in the Z direction. The pin **36** penetrates the through hole **522** of the protruding portion **521** and the through hole **351** of the flange **35**, and the



second actuator device **50** is attached to the intermediate column **3**.

[0059] In this manner, the pin **36** is attached to the flange **35** and the protruding portion **521** (attachment portion) of the second actuator device **50**. Therefore, since the attachment rigidity of the pin **36** is improved, the pin **36** is hardly damaged, and the outer column **4** can be more reliably prevented from falling off from the intermediate column **3**.

## Second Embodiment

[0060] Next, a second embodiment will be described. FIG. **5** is a perspective view of a steering device of the second embodiment. FIG. **6** is a side view of the steering device of the second embodiment. FIG. **7** is a cross-sectional view taken along line VII-VII of FIG. **6**.

[0061] In a steering device **100A** according to the second embodiment, a first frame (frame portion) **7A** and a second frame **8A** are provided in an outer column **4A**. Hereinafter, a specific description will be given.

[0062] As illustrated in FIGS. **5** to **7**, the outer column **4A** includes a main body portion **41A**, a first frame **7A** (frame portion), and a second frame **8A**.

[0063] The main body portion **41A** is provided on the **Z1** side and the **Z2** side. The main body portion **41A** extends along the **X** direction. As illustrated in FIG. **7**, the main body portion **41A** on the **Z1** side has a V-shaped cross section protruding toward the **Z1** side.

[0064] The first frame **7A** has a substantial U shape when viewed from the **X** direction.

Specifically, the first frame **7A** includes a pair of legs **71A** and a coupling portion **72A**. The pair of legs **71A** are separated in the **Z** direction. That is, the leg **71A** on the **Z1** side and the leg **71A** on the **Z2** side are coupled via the coupling portion **72A**. When viewed from the **X** direction, the first frame **7A** does not overlap a bracket **60** and a nut **62**. That is, when an inner column **2** moves in the **X** direction with respect to an intermediate column **3**, the bracket **60** and the nut **62** also move in the **X** direction. At this time, the bracket **60** and the nut **62** can pass through the inside of the first frame **7A**.

[0065] The second frame **8A** has a substantial U shape when viewed from the **X** direction.

Specifically, the second frame **8A** includes a pair of legs **81A** and a coupling portion **82A**. The pair of legs **81A** are separated in the **Z** direction. The second frame **8A** covers the outside of a protruding portion **521** and a flange **35**. In other words, the second frame **8A** overlaps the protruding portion **521** and the flange **35** when viewed from the **Y** direction.

[0066] Additionally, a second actuator unit **5** includes a second actuator device **50**. As described above, the second actuator device **50** includes a motor **51**, a gear box **52**, a screw shaft **53**, and a nut **62**. When viewed from the **X** direction, the first frame **7A** overlaps the motor **51** and the gear box **52**. Therefore, for example, the motor **51** and the gear box **52** in the second actuator device **50** can abut on the first frame **7A**.

[0067] As described above, in the steering device **100A** according to the second embodiment, the inner column **2** (third steering column) extending along the **X** direction is provided between a steering shaft **1** and the intermediate column **3** (first steering column), and the inner column **2** (third steering column) is movable relative to the intermediate column **3** (first steering column) in the **X** direction via the second actuator device **50**. The inner column **2** (third steering column) is movable relative to the intermediate column **3** (first steering column) in the **X** direction via the second actuator unit **5**, and the outer column **4** (second steering column) includes the first frame **7A** (frame portion) which is disposed on the **X2** side of the second actuator unit **5** and can abut on the motor **51** or the gear box **52** of the second actuator device **50**.

[0068] In the second embodiment, the first frame **7A** (frame portion) and the motor **51** or the gear box **52** of the second actuator device **50** can abut on each other. The second embodiment, too, can provide the steering device **100A** that can more reliably prevent the outer column **4** (second steering column) from falling off without increasing the overall length of the screw shaft **53**. Note that since the first frame **7A** (frame portion) and the motor **51** or the gear box **52** have higher rigidity than the pin **36** and the plate-shaped member **70** of the first embodiment, this, too, can

more reliably prevent the outer column **4** (second steering column) from falling off.

## REFERENCE SIGNS LIST

[0069] **1** STEERING SHAFT [0070] **2** INNER COLUMN (THIRD STEERING COLUMN)  
[0071] **3** INTERMEDIATE COLUMN (FIRST STEERING COLUMN) [0072] **31** FLAT  
PORTION [0073] **32** CURVED PORTION [0074] **33** OPEN PORTION [0075] **34** INNER  
PERIPHERAL WALL PORTION [0076] **35** FLANGE [0077] **351** THROUGH HOLE [0078] **36**  
PIN [0079] **36a** TIP PORTION [0080] **37** SNAP RING [0081] **4, 4A** OUTER COLUMN  
(SECOND STEERING COLUMN) [0082] **41, 41A** MAIN BODY PORTION [0083] **411** FIRST  
CIRCUMFERENTIAL END PORTION [0084] **412** SECOND CIRCUMFERENTIAL END  
PORTION [0085] **42** OPENING [0086] **43** ANNULAR MEMBER [0087] **5** SECOND  
ACTUATOR UNIT [0088] **50** SECOND ACTUATOR DEVICE [0089] **51** MOTOR [0090] **52**  
GEAR BOX [0091] **521** PROTRUDING PORTION (ATTACHMENT PORTION) [0092] **522**  
THROUGH HOLE [0093] **53** SCREW SHAFT [0094] **60** BRACKET [0095] **61** CUTOUT  
PORTION [0096] **62** NUT [0097] **63** PROTRUSION [0098] **64** BRACKET [0099] **66** CUTOUT  
PORTION [0100] **67** NUT [0101] **68** PROTRUSION [0102] **7** PROJECTION [0103] **70** PLATE-  
SHAPED MEMBER [0104] **71** CUTOUT PORTION [0105] **72** END SURFACE (SIDE) [0106] **73**  
END SURFACE (SIDE) [0107] **74** END SURFACE (SIDE) [0108] **7A** FIRST FRAME (FRAME  
PORTION) [0109] **71A** LEG [0110] **72A** COUPLING PORTION [0111] **8A** SECOND FRAME  
[0112] **81A** LEG [0113] **82A** COUPLING PORTION [0114] **100, 100A** STEERING DEVICE  
[0115] **101** GEAR BOX [0116] **102** ELECTRIC MOTOR [0117] **104** ECU [0118] **105** STEERING  
WHEEL [0119] **106** MOTOR [0120] **107** GEAR BOX [0121] **108** SCREW SHAFT [0122] **110**  
ATTACHMENT MEMBER [0123] **111** ATTACHMENT PORTION [0124] **112** FIRST  
ACTUATOR DEVICE [0125] **113** FIRST ACTUATOR UNIT [0126] **114** FLANGE [0127] **AX1**  
FIRST CENTRAL AXIS [0128] **AX2** SECOND CENTRAL AXIS [0129] **AX3** THIRD CENTRAL  
AXIS

## Claims

1. A steering device comprising: a steering shaft extending in a first direction and having a steering wheel coupled to an end portion on one side in the first direction; a first steering column arranged outside the steering shaft; and a second steering column arranged outside the first steering column and is movable relative to the first steering column in the first direction via a first actuator device, wherein the first steering column includes a pin extending in a second direction intersecting the first direction, and the second steering column includes a projection arranged on one side in the first direction of the pin and capable of abutting on the pin.
2. The steering device according to claim 1, wherein the projection protrudes in a third direction intersecting the first direction and the second direction.
3. The steering device according to claim 2, wherein the projection is provided with a cutout portion on an other side in the first direction, and the pin is capable of abutting on the cutout portion.
4. The steering device according to claim 3, wherein the projection is a plate-shaped member having a rectangular shape when viewed from the second direction, and the cutout portion is provided at a corner between a side on the other side in the first direction and a side on one side in the third direction in the plate-shaped member.
5. The steering device according to claim 1, wherein: a third steering column extending along the first direction is provided between the steering shaft and the first steering column; the third steering column is movable relative to the first steering column in the first direction via a second actuator device; and the second actuator device is attached to the first steering column via the pin.
6. The steering device according to claim 5, wherein: a through hole penetrating in a second direction is provided in an attachment portion of the second actuator device to the first steering

column; the first steering column has a flange protruding to one side in a third direction, the flange being provided with a through hole penetrating in the second direction; and the pin penetrates the through hole of the attachment portion and the through hole of the flange, and the second actuator device is attached to the first steering column.

7. A steering device comprising: a steering shaft extending in a first direction and having a steering wheel coupled to an end portion on one side in the first direction; a first steering column arranged outside the steering shaft; a second steering column arranged outside the first steering column and is movable relative to the first steering column in the first direction; and a third steering column arranged between the steering shaft and the first steering column and extending along the first direction, wherein the third steering column is movable relative to the first steering column in the first direction via an actuator device including a motor and a gear box, and the second steering column includes a frame portion that is arranged on one side in the first direction of the motor and the gear box and is capable of abutting on the motor or the gear box.

---