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(54) **END CAP HOLDER FOR A GAS CYLINDER**

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F17C 13/04 (2006.01)
F17C 13/06 (2006.01)

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(Continued)

(58) **Field of Classification Search**
CPC ... F17C 13/04; F17C 16/06; F17C 2205/0308
See application file for complete search history.

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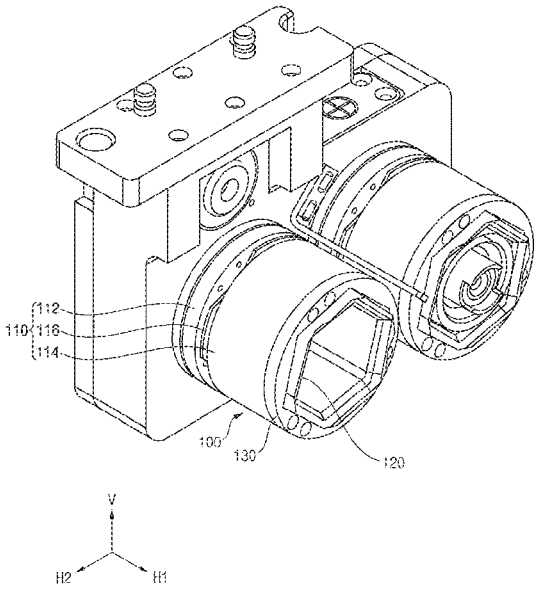
(57) **ABSTRACT**

An end cap holder may include a base block and a holding block. The base block may be configured to provide an end cap, which may be at a nozzle of the gas cylinder, with a torque for combining/separating the end cap with/from the nozzle. An angle correction groove may be formed at a first surface of the base block oriented toward the end cap. The holding block may be rotatably receivable in the angle correction groove to hold the end cap. The holding block may selectively make point contact with the base block to transmit the torque of the base block to the end cap. Thus, the holding block may accurately hold the end cap tilted to a vertical axis or a horizontal axis.

10 Claims, 6 Drawing Sheets



(52) **U.S. Cl.**
CPC *F17C 2205/0311* (2013.01); *F17C 2205/0323* (2013.01); *F17C 2209/22* (2013.01)

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FIG. 1

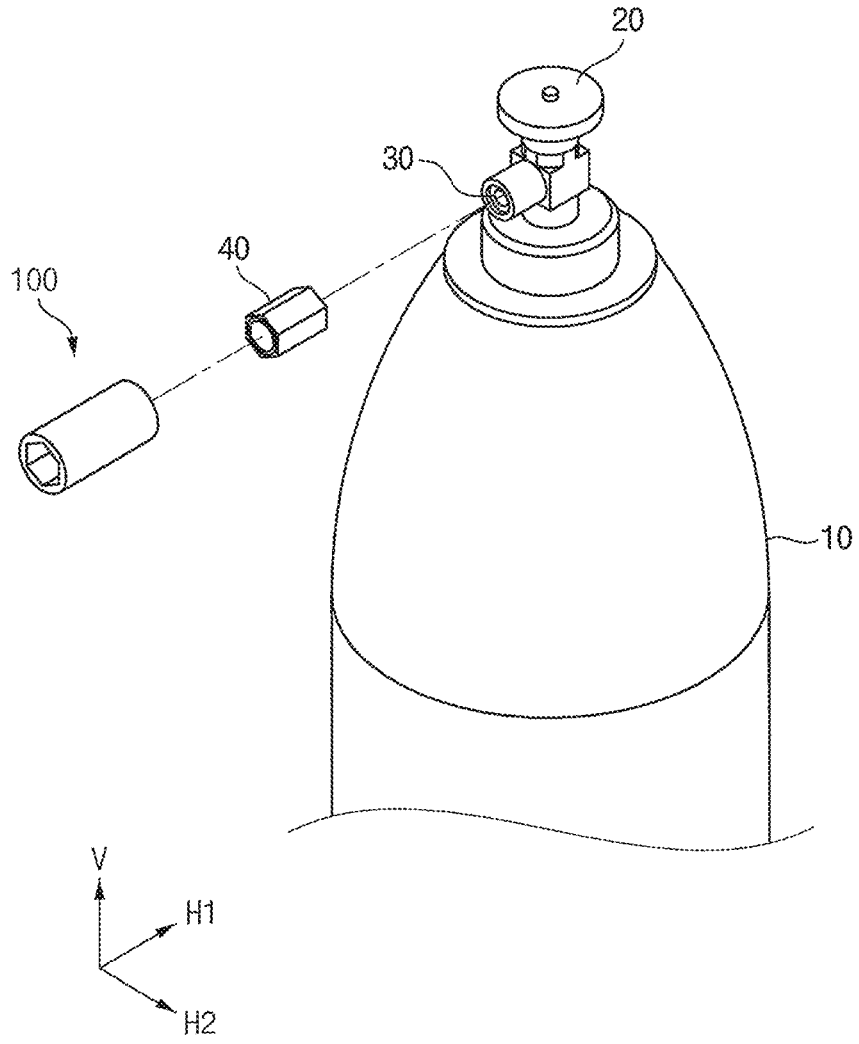


FIG. 2

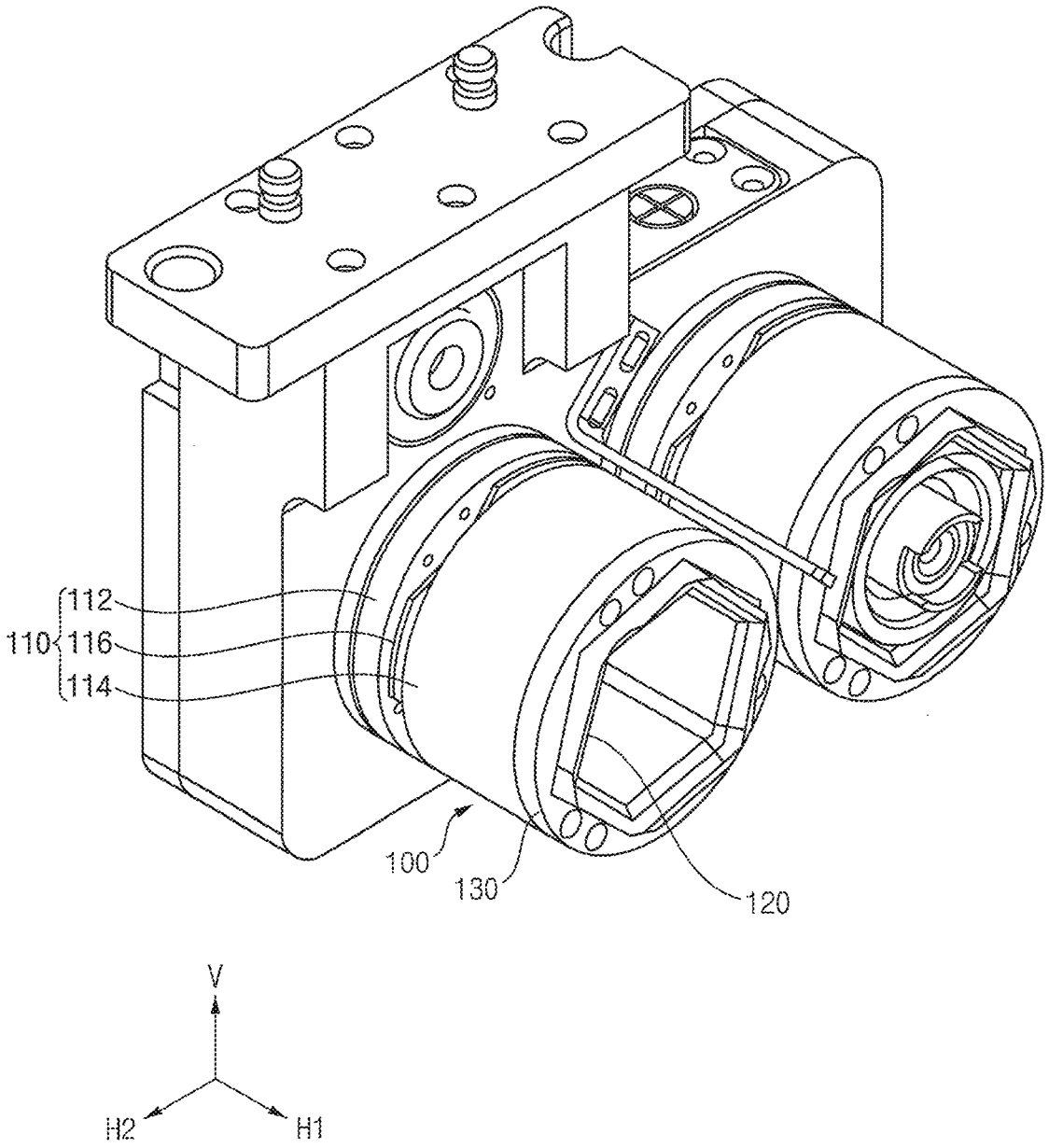


FIG. 3

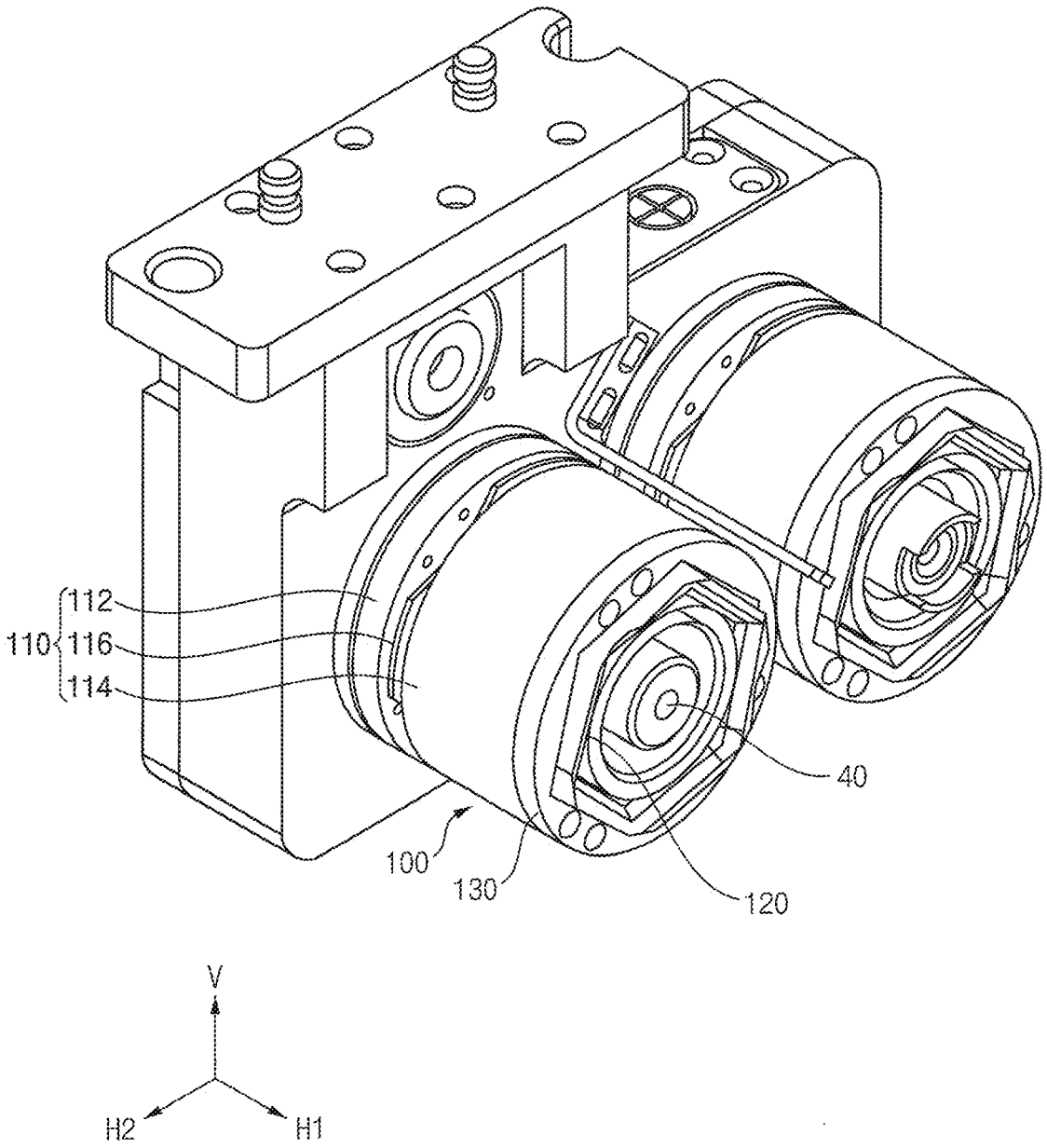


FIG. 4

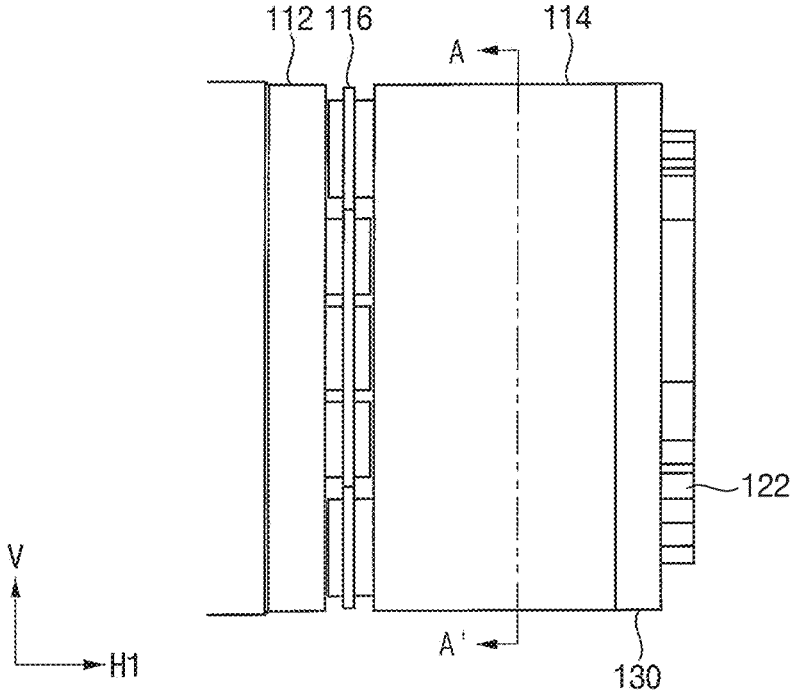


FIG. 5

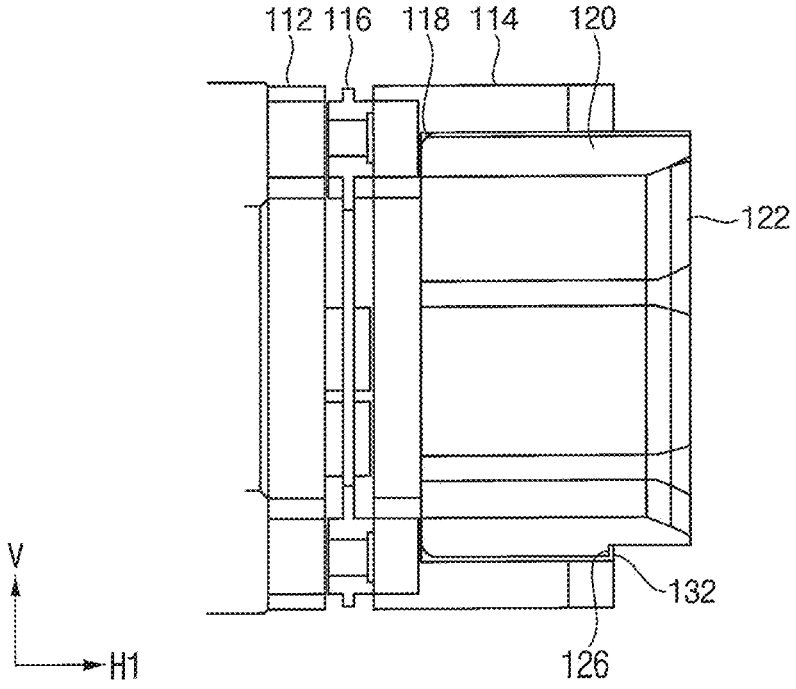


FIG. 6

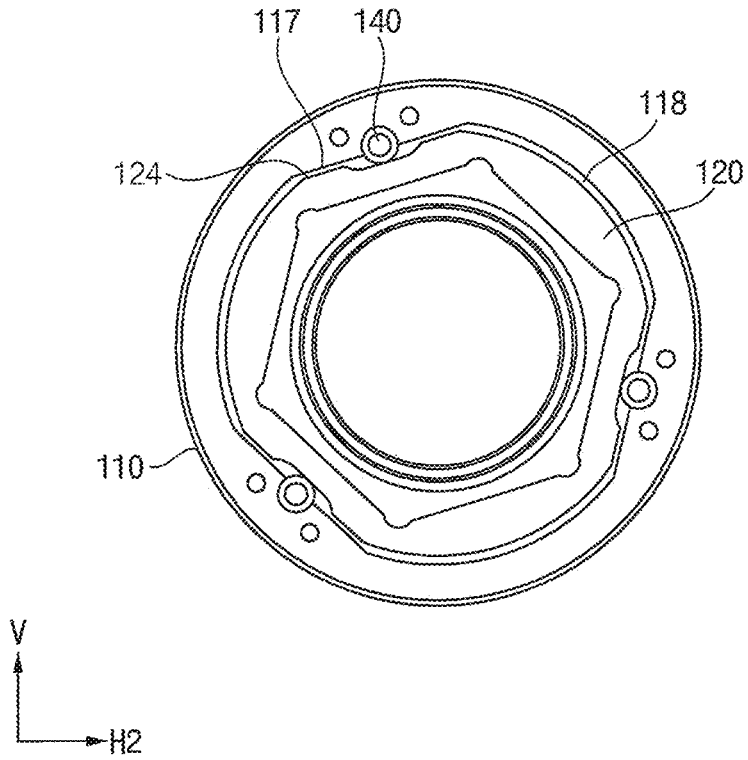


FIG. 7

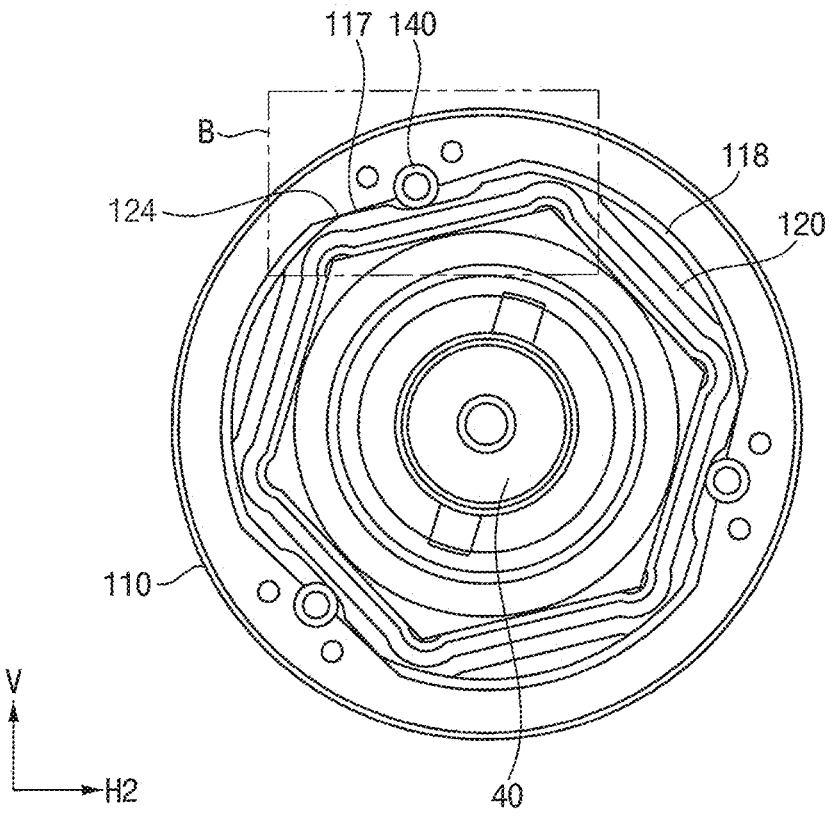
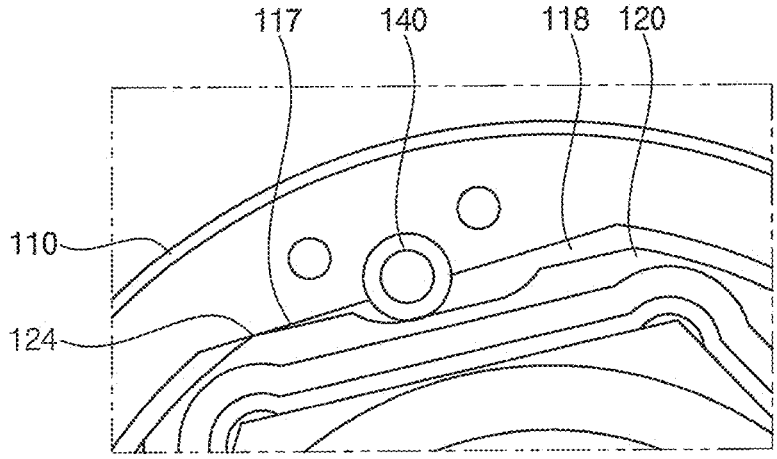


FIG. 8



END CAP HOLDER FOR A GAS CYLINDER

CROSS-RELATED APPLICATION

This application claims priority under 35 USC § 119 to Korean Patent Application No. 10-2021-0089550, filed on Jul. 8, 2021 in the Korean Intellectual Property Office (KIPO), the contents of which are herein incorporated by reference in their entirety.

BACKGROUND

1. Field

Example embodiments relate to an end cap holder for a gas cylinder. More particularly, example embodiments relate to an end cap holder configured to combine/separate an end cap with/from a nozzle of a gas cylinder.

2. Description of the Related Art

Generally, various gases may be used for fabricating a semiconductor device. The gases may be stored in a gas cylinder. The gas cylinder may include a nozzle configured to inject the gas and a valve configured to open and close the nozzle. The nozzle may be sealed with an end cap. The end cap may be automatically combined/separated with/from the nozzle by a torque provided from an exchanger. The torque may be transmitted to the end cap through a holder configured to hold the end cap.

According to related arts, when the valve may be tilted to a vertical axis, the end cap may also be slanted to the vertical axis. Thus, the end cap holder may not accurately hold the end cap.

SUMMARY

Example embodiments provide an end cap holder for a gas cylinder that may be capable of accurately holding a tilted end cap.

According to example embodiments, there may be provided an end cap holder for a gas cylinder. The end cap holder may include a base block and a holding block. The base block may be configured to provide an end cap, which may be at a nozzle of the gas cylinder, with a torque for combining/separating the end cap with/from the nozzle. An angle correction groove may be at a first surface of the base block oriented toward the end cap. The holding block may be rotatably receivable in the angle correction groove to hold the end cap. The holding block may selectively make point contact with the base block to transmit the torque of the base block to the end cap.

According to example embodiments, the holding block may be rotatably receivable in the angle correction groove so that the holding block may accurately hold the end cap tilted to a vertical axis or a horizontal axis. Thus, a time for assembling/disassembling the end cap may be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Example embodiments will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings. FIGS. **1** to **8** represent non-limiting, example embodiments as described herein.

FIG. **1** is an exploded perspective view illustrating a gas cylinder with an end cap holder in accordance with example embodiments;

FIG. **2** is a perspective view illustrating a gas cylinder with an end cap holder in accordance with example embodiments;

FIG. **3** is a perspective view illustrating an end cap held by the end cap holder in FIG. **2**;

FIG. **4** is a side view illustrating the end cap holder in FIG. **2**;

FIG. **5** is a cross-sectional view illustrating the end cap holder in FIG. **4**;

FIG. **6** is a cross-sectional view taken along a line A-A' in FIG. **4**;

FIG. **7** is a cross-sectional view illustrating an end cap held by the end cap holder in FIG. **6**; and

FIG. **8** is an enlarged cross-sectional view of a portion "B" in FIG. **7**.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

Hereinafter, example embodiments will be explained in detail with reference to the accompanying drawings.

FIG. **1** is an exploded perspective view illustrating a gas cylinder with an end cap holder in accordance with example embodiments, FIG. **2** is a perspective view illustrating a gas cylinder with an end cap holder in accordance with example embodiments and FIG. **3** is a perspective view illustrating an end cap held by the end cap holder in FIG. **2**.

Referring to FIGS. **1** to **3**, a valve **20** may be installed at an upper end of a gas cylinder **10**. A nozzle **30** may be horizontally installed at the valve **20**. An end cap **40** may be installed at the nozzle **30**. An end cap holder **100** may be configured to selectively hold the end cap **40**.

In example embodiments, an axial direction of the valve **20** may be a vertical direction V. An axial direction of the end cap **40** substantially perpendicular to the valve **20** may be a first horizontal direction HE A second horizontal direction H**2** may be substantially perpendicular to the first horizontal direction HE Further, a first surface may be oriented toward the end cap **40**. A second surface may be opposite to the first surface.

When the gas cylinder **10** may be exchanged with new one, the end cap **40** may be separated from the nozzle **30** using the end cap holder **100** of an exchanger. A gas line may be connected to the nozzle **30** to supply a gas to the gas cylinder **10**. After supplying the gas, the end cap **40** may be combined with the nozzle **30** using the end cap holder **100**. The end cap holder **100** may be configured to transmit a torque of the exchanger to the end cap **40**.

During combining and separating the end cap **40**, the valve **20** may be tilted to the vertical direction V and/or the second horizontal direction H**2**. Thus, the end cap **40** may also be tilted to the vertical direction V and/or the second horizontal direction H**2**. A conventional end cap holder may not accurately hold the tilted end cap **40**. However, the end cap holder **100** of example embodiments may have a function for correcting a tilted angle of the end cap **40** to accurately hold the tilted end cap **40**.

FIG. **4** is a side view illustrating the end cap holder in FIG. **2**, FIG. **5** is a cross-sectional view illustrating the end cap holder in FIG. **4**, FIG. **6** is a cross-sectional view taken along a line A-A' in FIG. **4**, FIG. **7** is a cross-sectional view illustrating an end cap held by the end cap holder in FIG. **6** and FIG. **8** is an enlarged cross-sectional view of a portion "B" in FIG. **7**.

Referring to FIGS. **4** to **8**, the end cap holder **100** may include a base block **110**, a holding block **120** and/or a stopping block **130**.

The base block **110** may have a cylindrical shape. Thus, the base block **110** may have an axial direction corresponding to the first horizontal direction H1. The base block **110** may be configured to provide the end cap **40** with the torque of the exchanger.

The base block **110** may include an angle correction groove **118**. The angle correction groove **118** may be formed at a first surface of the base block **110** oriented toward the end cap **40**. In example embodiments, the angle correction groove **118** may have a cylindrical shape, not limited thereto.

In example embodiments, the base block **110** may include a first block **112**, a second block **114** and/or a disc coupling **116**. The angle correction groove **118** may be formed at the second block **114**. The disc coupling **116** may be positioned between the first block **112** and the second block **114** to connect the first block **112** and the second block **114** with each other for allowing a relative movement. The disc coupling **116** may include a plurality of discs overlapped with each other. The disc coupling **116** may have a function for correcting a misalignment between the end cap **40** and the end cap holder **100** and for transmitting the torque. Alternatively, the base block **110** may include a single block.

The holding block **120** may be configured to hold the end cap **40**. When the end cap **40** may have a hexagonal bolt shape, the holding block **120** may include a hexagonal holding nut **122** configured to hold the end cap **40**. The holding nut **122** may be formed at a first surface of the holding block **120** oriented toward the end cap **40**.

The holding block **120** may be partially received in the angle correction groove **118** of the base block **110**. That is, a second surface of the holding block **120** may enter into the angle correction groove **118**. In contrast, the first surface of the holding block **120** may protrude from the angle correction groove **118** toward the end cap **40** in the first horizontal direction H1. Thus, the holding nut **122** on the first surface of the holding block **120** may also protrude from the angle correction groove **118** toward the end cap **40** in the first horizontal direction H1. Therefore, the holding block **120** may have a diameter slightly smaller than a diameter of the angle correction groove **118**.

In example embodiments, the holding block **120** may be rotatably receivable in the angle correction groove **118**. For example, the holding block **120** may be rotatably receivable in the angle correction groove **118** centering around the first horizontal direction H1. Further, the holding block **120** may be rotatably receivable in the angle correction groove **118** centering around the vertical direction V and/or the second horizontal direction H2. That is, an outer circumferential surface of the holding block **120** may not make contact with an inner circumferential surface of the angle correction groove **118** so that the holding block **120** may be slightly tilted in the angle correction groove **118** centering around the vertical direction V and/or the second horizontal direction H2. By tilting the holding block **120** in the angle correction groove **118** centering around the vertical direction V and/or the second horizontal direction H2, the holding block **120** may approach the end cap **40** to accurately align the holding block **120** with the end cap **40** tilted to the vertical direction V and/or the second horizontal direction H2. As a result, the holding nut **122** of the holding block **120** may be inserted into the tilted end cap **40** so that the holding block **120** may accurately hold the end cap **40**.

Further, the holding block **120** may be movably received in the angle correction groove **118** with respect to a center of the angle correction groove **118**. Thus, although a center of the holding block **120** may not be aligned with a center of the end cap **40**, during the holding block **120** may approach to the end cap **40**, the center of the holding block **120** may be aligned with the center of the end cap **40** such that the holding block **120** may accurately hold the end cap **40**.

In order to combine/separate the end cap **40** with/from the gas cylinder **10**, the holding block **120** may have a function for transmitting the torque of the base block **110** to the end cap **40**. The holding block **120** may be configured to selectively make point contact with the base block **110**.

For example, a plurality of straight contact surfaces **117** may be formed at the inner circumferential surface of the base block **110**. The contact surfaces **117** may be spaced apart from each other by a uniform gap. The holding block **120** may include a plurality of angular contact portions **124**. Each of the contact portions **124** may correspond to both ends of a linear surface formed at the inner circumferential surface of the holding block **120**. That is, when the linear surface may be partially formed on the inner circumferential surface of the holding block **120**, angular portions at the both ends of the linear surface may be formed of the contact portions **124**. The contact portions **124** may be spaced apart from each other by a uniform gap.

As mentioned above, because the holding block **120** may be rotatably received in the angle correction groove **118**, the outer circumferential surface of the holding block **120** may not make contact with the inner circumferential surface of the base block **110**. That is, because the contact portions **124** may be positioned in the angle correction groove **118**, the contact portions **124** may also not make contact with the contact surfaces **117**.

When the base block **110** may be rotated after holding the end cap **40** by the holding block **120**, at least one of the contact portions **124** may make point contact with the contact surface **117**. The contact portion **124** may have a radius longer than a radius of the contact surface **117**. Thus, the holding block **120** may not be rotated centering around the first horizontal direction H1 after the contact portion **124** may make point contact with the contact surface **117**. Therefore, the torque of the base block **110** may be applied to the end cap **40** through the holding block **120**.

The stopping block **130** may be arranged at the first surface of the base block **110**. The stopping block **130** may have an annular shape. Thus, the stopping block **130** may be rotated together with the base block **110**. The stopping block **130** may have an inner diameter slightly longer than an outer diameter of the holding block **120**. Thus, the holding block **120** may pass through the annular stopping block **130**.

The stopping block **130** may be configured to reduce or prevent the holding block **120** in the angle correction groove **118** from being released toward the end cap **40** in the first horizontal direction H1. The stopping block **130** may include a stopper **132** formed from an inner circumferential surface of the stopping block **130** toward the center of the angle correction groove **118**. The stopper **132** may block a step formed on the outer circumferential surface of the holding block **120** to reduce or prevent the release of the holding block **120** from the angle correction groove **118**.

Additionally, a plurality of resilient members **140** may be arranged in the angle correction groove **118**. The resilient members **140** may be configured to resiliently support the holding block toward the center of the base block **110** to locate the holding block **120** at the center of the base block **110**. Each of the resilient members **140** may be fixed to the inner surface of the angle correction groove **118** to resiliently support the holding block toward the center of the base block **110**. In order to apply a uniform resilient force to

the holding block **120**, the resilient members **140** may be spaced apart from each other by a uniform gap. In example embodiments, the resilient members **140** may include plate springs, not limited thereto. For example, the resilient members **140** may include rubber.

In example embodiments, each of the resilient members **140** may be positioned between the adjacent contact portions **117** of the holding block **120**, not limited thereto. Further, each of the resilient members **140** may be arranged in a receiving groove **119** formed at the outer circumferential surface of the holding block **120**.

According to example embodiments, the holding block may be rotatably received in the angle correction groove so that the holding block may accurately hold the end cap tilted to a vertical axis or a horizontal axis. Thus, a time for assembling/disassembling the end cap may be reduced.

The foregoing is illustrative of example embodiments and is not to be construed as limiting thereof. Although a few example embodiments have been described, those skilled in the art will readily appreciate that many modifications are possible in the example embodiments without materially departing from the novel teachings and advantages of the present inventive concepts. Accordingly, all such modifications are intended to be included within the scope of the present inventive concepts as defined in the claims. In the claims, means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures. Therefore, it is to be understood that the foregoing is illustrative of various example embodiments and is not to be construed as limited to the specific example embodiments disclosed, and that modifications to the disclosed example embodiments, as well as other example embodiments, are intended to be included within the scope of the appended claims.

What is claimed is:

1. An end cap holder for a gas cylinder, the end cap holder comprising:

a base block configured to apply a torque, which is used for combining/separating an end cap at a nozzle of the gas cylinder, to the end cap, the base block including an angle correction groove, and the angle correction groove at a first surface of the base block oriented toward the end cap; and

a holding block rotatably receivable in the angle correction groove, the holding block including a holding nut configured to hold the end cap, and the holding block configured to selectively make point contact with the base block to transmit the torque of the base block to the end cap.

2. The end cap holder of claim **1**, wherein the holding block is rotatably receivable in the angle correction groove centering around a second horizontal direction substantially perpendicular to a first horizontal direction corresponding to an axial direction of the end cap.

3. The end cap holder of claim **2**, wherein the holding block is rotatably receivable in the angle correction groove centering around a vertical direction substantially perpendicular to the first horizontal direction.

4. The end cap holder of claim **3**, wherein the holding block is movably receivable in the angle correction groove with respect to a center of the angle correction groove.

5. The end cap holder of claim **1**, wherein a plurality of straight contact surfaces is formed on an inner circumferential surface of the base block, and a plurality of angular contact portions, which are configured to selectively make point contact with the contact surfaces, is formed on an outer circumferential surface of the holding block.

6. The end cap holder of claim **5**, wherein each of the contact portions corresponds to both ends of a linear surface formed on the outer circumferential surface of the holding block.

7. The end cap holder of claim **1**, wherein the base block comprises:

a first block;

a second block including the angle correction groove; and

a disc coupling arranged between the first block and the second block to connect the first block and the second block with each other for allowing a relative movement.

8. The end cap holder of claim **1**, further comprising a stopping block at the first surface of the base block configured to prevent a release of the holding block from the angle correction groove toward the end cap.

9. The end cap holder of claim **8**, wherein the stopping block comprises a stopper protruding from an inner surface of the stopping block toward the holding block to prevent the release of the holding block.

10. The end cap holder of claim **1**, further comprising a plurality of resilient members on an inner surface of the angle correction groove to resiliently support the holding block toward a center of the base block.

* * * * *