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(54) TIGHTENING STRUCTURE FOR LOCKING AND NUT AND WASHER FOR THE TIGHTENING STRUCTURE

(76) Inventor: **Teruo Nakagami**, Tatebe Youkaichi-city (JP)

Correspondence Address:
HOWSON AND HOWSON
ONE SPRING HOUSE CORPORATION CENTER
BOX 457
321 NORRISTOWN ROAD
SPRING HOUSE, PA 19477 (US)

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(57) **ABSTRACT**

A tightening structure for locking, comprising a nut, a bolt, and a hole for passing the bolt therethrough, wherein, to more firm the locking, a recessed part symmetrical with respect to an axis and formed in a generally trapezoidal shape in cross section is formed in the nut on an inner washer side, a projected part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed on the washer on an inner nut side, and the recessed part of the nut is fitted to the projected part of the washer, and a hole in the washer is positioned on the inner side of the projected part and the center position of the hole is positioned eccentric to the center position of the projected part of the washer.

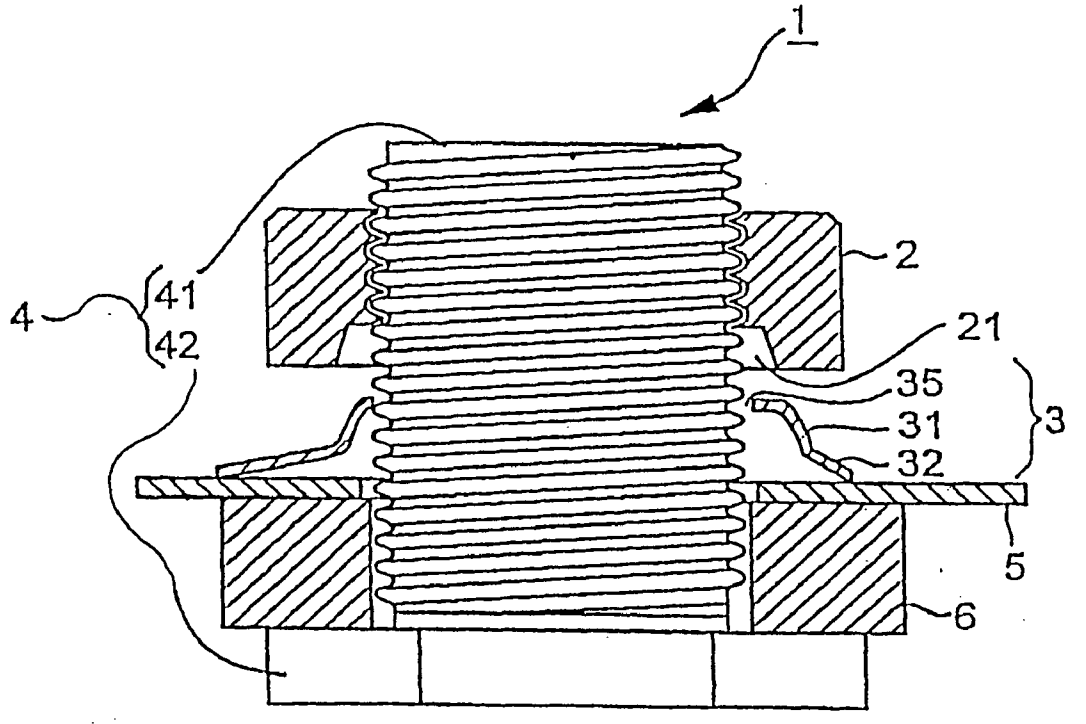


FIG. 1

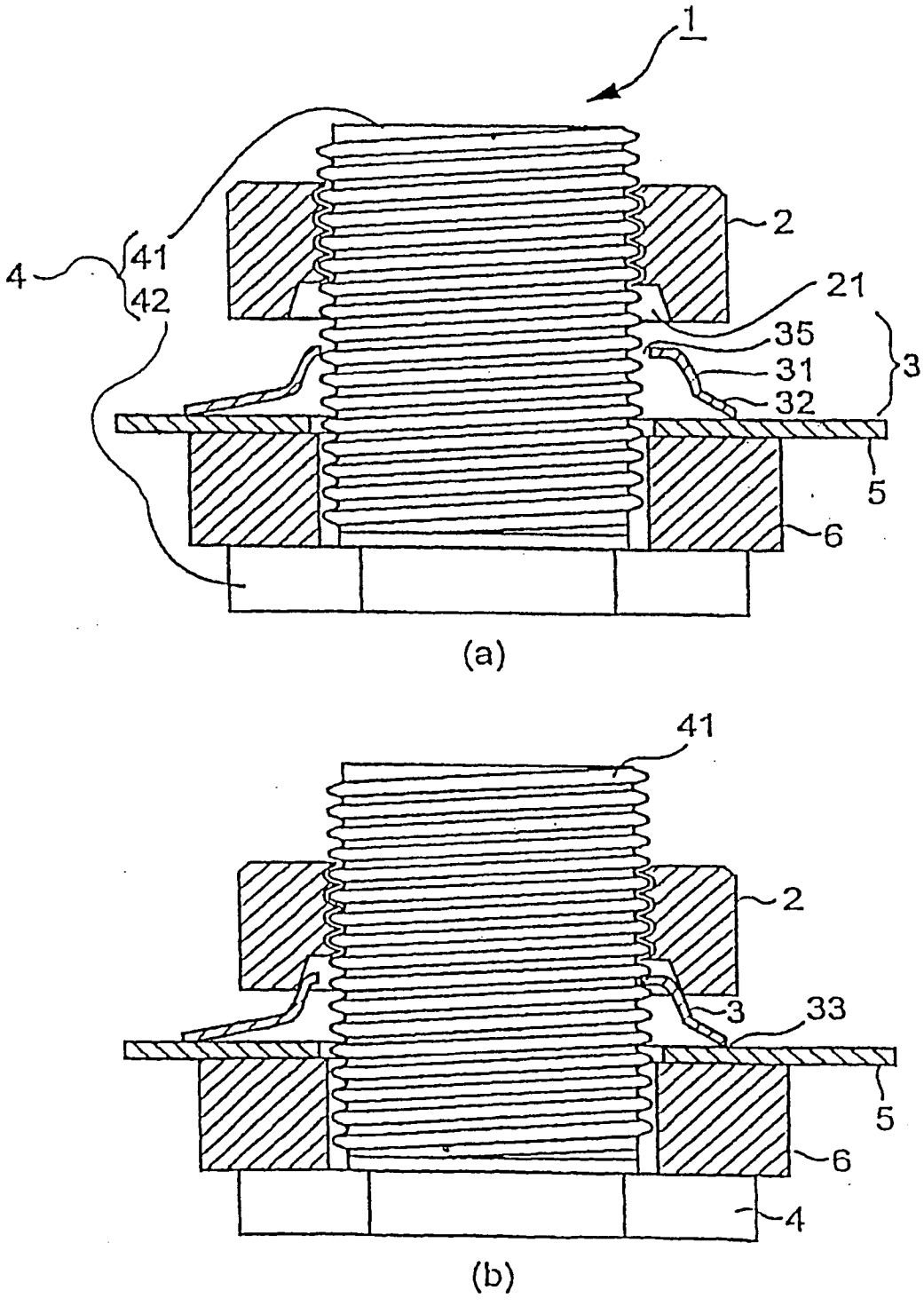


FIG. 2

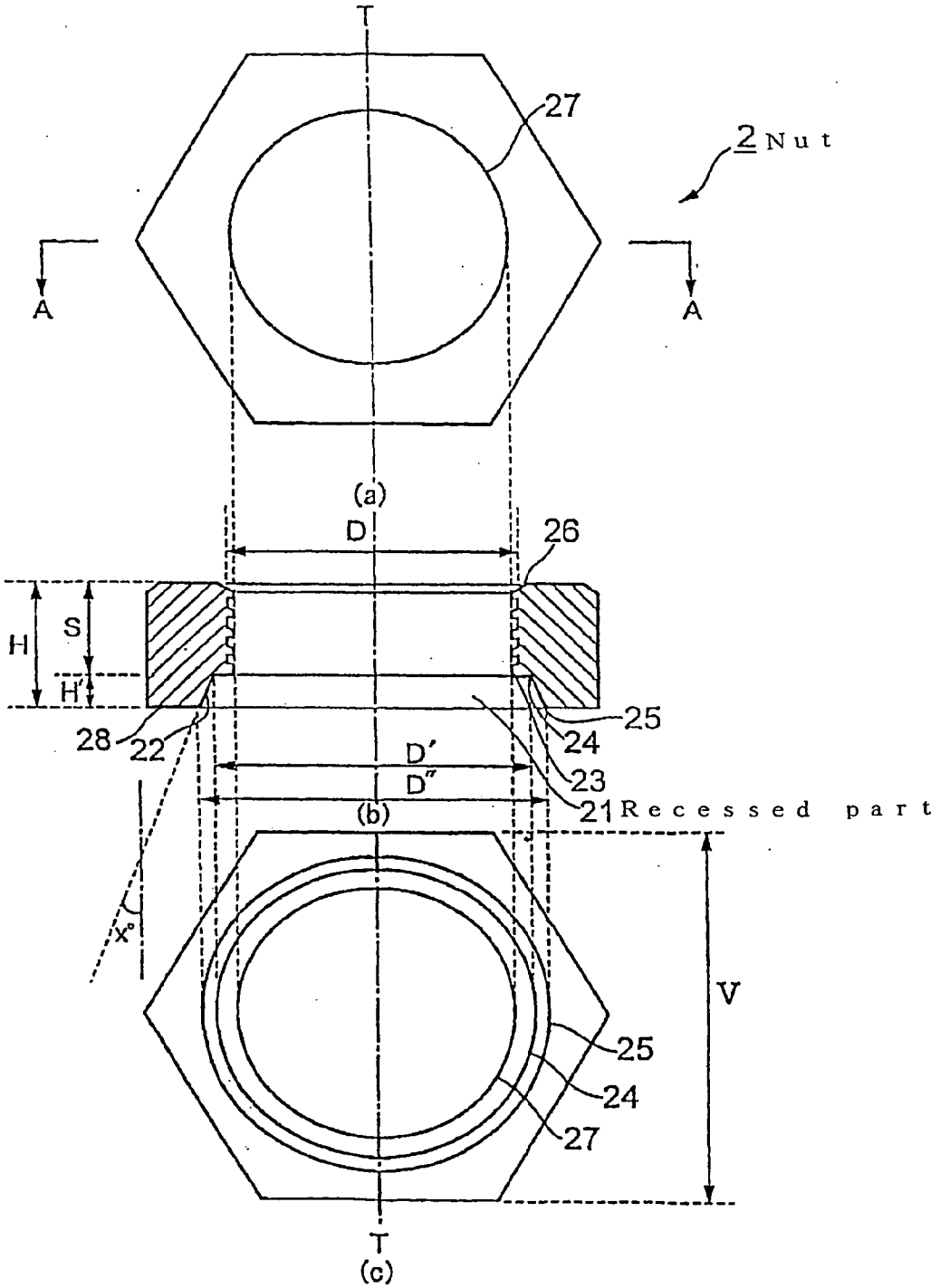

T
27
2 Nut
A
A
(a)
D
26
H
S
H'
28
22
25
24
23
21
Recessed part
D'
D''
(b)
x°
V
25
24
27
T
(c)

FIG. 3

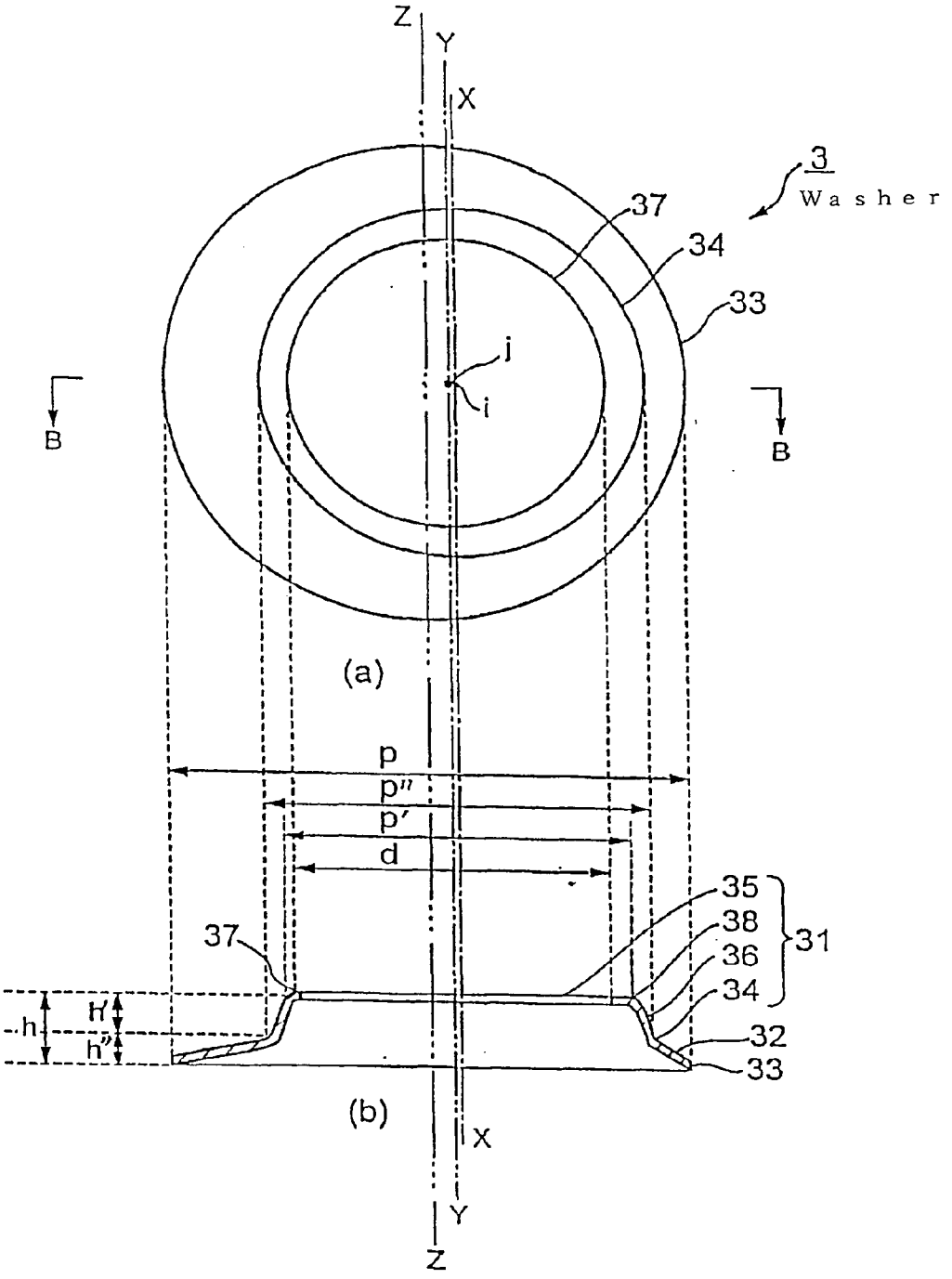


FIG. 4



FIG. 5

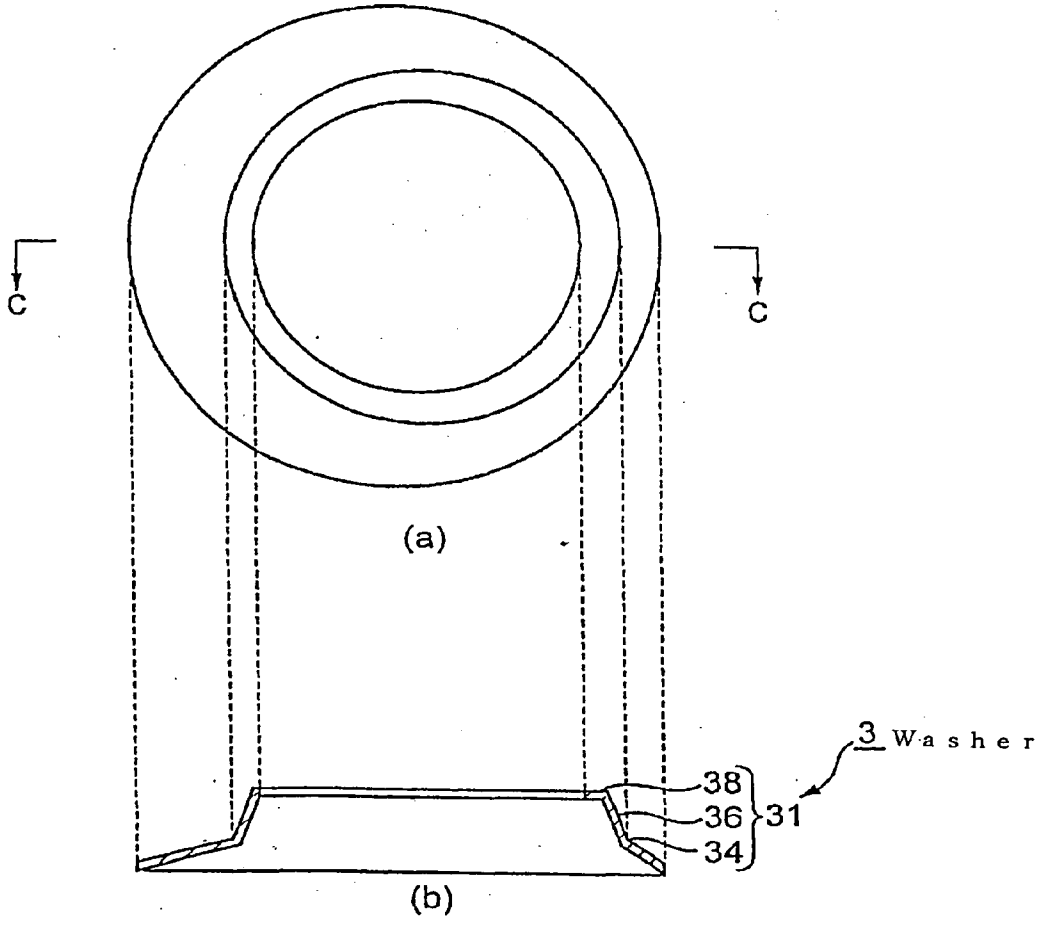
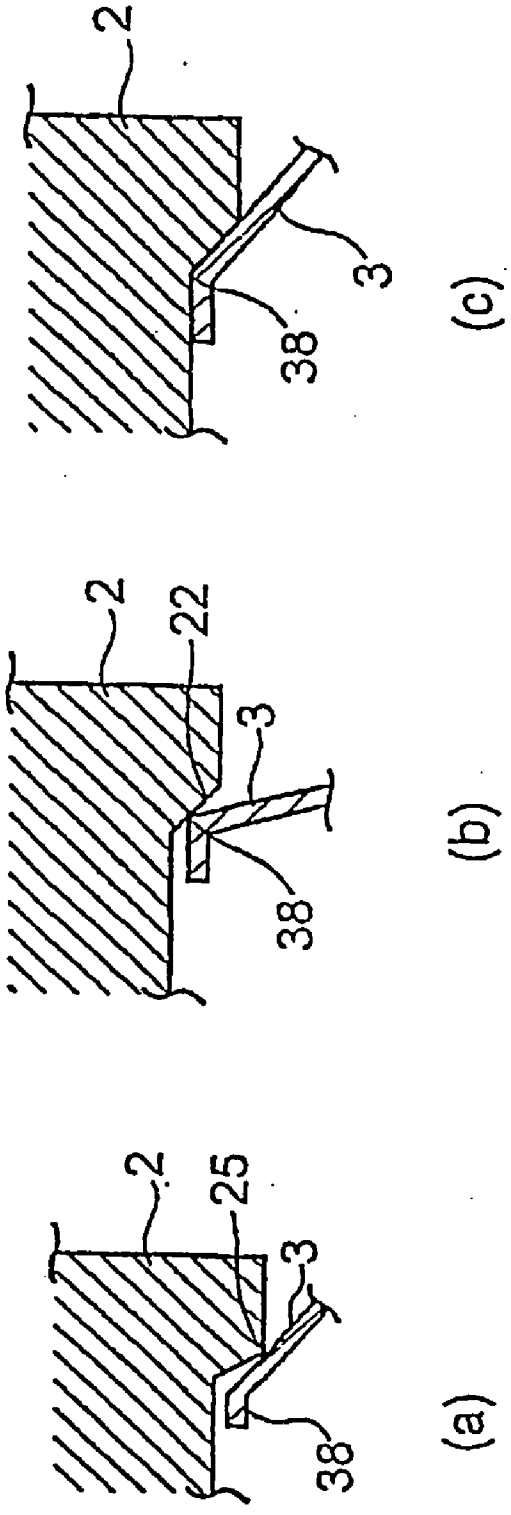


FIG. 6



TIGHTENING STRUCTURE FOR LOCKING AND NUT AND WASHER FOR THE TIGHTENING STRUCTURE

TECHNICAL FIELD

[0001] This invention is concerned with tightening structure for locking and nut and washer for the tightening structure, for example, for using in construction structure.

BACKGROUND

[0002] Tightening structure for locking using nut and bolt had big problem as to the locking after tightening bolt and nut, in the past. In order to solve this problem, a washer is generally used between bolt and nut. For example, the pages 45 to 46 of "Story of Screw" (author:Akira Yamamoto, Published by Zaidanhojin Nihonkikakukyokai, Published in Oct. 30, 1990) discloses the technique using plane washer or spring washer. Japan Patent Laying Open Gazette:Tokukaiheil-182614 discloses a washer adapted to spherical surface as special form of washer.

[0003] But, even in the above-writtened prior tightening structure for locking, the effect of the locking after tightening bolt and nut, is unsufficient with the result that there still was a problem that unlocking between bolt and nut arose inevitably. Therefore, this invention has been performed in order to solve this problem and the purpose of this invention lies in providing the tightening structure for locking which can perform more firm function of locking and can more firmly strengthen the locking after tightening bolt and nut.

DISCLOSURE OF INVENTION

[0004] In order to achieve the above object, according to the present invention, a tightening structure for locking, comprising a nut, a bolt, and a washer with a hole through which an axis of said bolt passes, wherein, a recessed part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed in the nut on an inner washer side, a projected part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed on the washer on an inner nut side, and the recessed part of the nut is fitted to the projected part of the washer, and the hole in the washer is positioned on the inner side of the projected part and the center position of the hole is positioned eccentric to the center position of the projected part of the washer, is provided. Herein, the "the recessed part of the nut is fitted to the projected part of the washer" means that the center axis of the recessed part and the center axis of the projected part is common and the recessed part and the projected part have the relation for fitting.

[0005] In addition, it is preferable that a nut for a tightening structure for locking, comprising a nut, a bolt, and a washer with a hole through which an axis of the bolt passes, wherein, a recessed part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed in the nut on an inner washer side, is provided

[0006] In addition, it is preferable that a washer for a tightening structure for locking comprising a nut, a bolt, and a washer with a hole through which an axis of the bolt passes, wherein, a projeted part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed on the washer on an inner nut side, and the hole in the washer is positioned on the inner side of the projected part and the center position of the hole is positioned eccentric to the center position of the projected part of the washer, is provided.

[0007] In addition, it is preferable that a tightening structure for locking, in which the recessed part of the nut is fitted to the projected part of the washer, wherein, the recessed part comprises an upper surface part and an sloping part, the projected part comprises an upper surface part and an sloping part, a form of the fitting is that the sloping part of the recessed part is formed in plane form and the sloping part of the projected part is formed in curved form, is provided.

[0008] In addition, it is preferable that a tightening structure for locking, in which the recessed part of the nut is fitted to the projected part of the washer, wherein, the recessed part comprises an upper surface part and an sloping part, the projected part comprises an upper surface part and an sloping part, a form of the fitting is that an angle of the sloping part of the recessed part is a little larger than an angle of the sloping part of the projected part, is provided.

[0009] In addition, it is preferable that a tightening structure for locking, in which the recessed part of the nut is fitted to the projected part of the washer, wherein, the recessed part comprises an upper surface part and an sloping part, the projected part comprises an upper surface part and an sloping part, a form of the fitting is that an angle of the sloping part of the recessed part is a little smaller than an angle of the sloping part of the projected part, is provided.

[0010] In addition, it is preferable that a tightening structure for locking, in which the recessed part of the nut is fitted to the projected part of the washer, wherein, the recessed part comprises an upper surface part and an sloping part, the projected part comprises an upper surface part and an sloping part, a form of the fitting is that an angle of the sloping part of the recessed part is the same as an angle of the sloping part of the projected part, is provided.

[0011] In addition, it is preferable that a nut for a tightening structure for locking, in which the projected part is formed in curved form, is provided.

[0012] In addition, it is preferable that a tightening structure for locking, in which the projected part of the washer has a supporting part therebeneath, is provided.

[0013] In addition, it is preferable that a washer for a tightening structure for locking, in which the projected part has a supporting part therebeneath, is provided.

[0014] In addition, it is preferable that a tightening structure for locking, in which the supporting part is horizontal with respect to an tightened object, is provided.

[0015] In addition, it is preferable that a washer for a tightening structure for locking, in which the supporting part is horizontal with respect to an tightened object, is provided.

[0016] In addition, it is preferable that a tightening structure for locking, in which the ratio between a height of the female screwing part and a height of the recessed part in the nut is approximately 2 to 1, is provided .

[0017] In addition, it is preferable that a nut for a tightening structure for locking, in which the ratio between a

height of the female screwing part and a height of the recessed part in the nut is approximately 2 to 1, is provided.

[0018] In addition, it is preferable that a tightening structure for locking, in which a solping angle of the sloping part in the nut is approximately 10 degree with respect to the center axis, is provided.

[0019] In addition, it is preferable that a nut for a tightening structure for locking, in which a sloping angle of the sloping part in the nut is approximately 10 degree with respect to the center axis, is provided.

[0020] In addition, it is preferable that a tightening structure for locking, wherein a diameter of a circle consisting of the most heightened points of the sloping part of the projected part of the washer, is equal to or smaller than an diameter of the upper crossing points of the recessed part of the nut and a diameter of a circle consisting of the lower points of the sloping part of the projected part of the washer, is equal to or larger than an diameter of the lower crossing points of the recessed part of the nut, is provided.

[0021] In addition, it is preferable that a tightening structure for locking, wherein a diameter of the hole of the washer is higher than an outer diameter of the female screwing part by the height of the ditch of the female screwing part of the nut, is provided.

[0022] In addition, it is preferable that a tightening structure for locking, wherein the nut is higher than the washer, is provided.

[0023] In addition, it is preferable that a tightening structure for locking, wherein a thickness of the material of the washer is smaller than the pitch of the screwing part of the bolt, is provided.

[0024] In addition, it is preferable that a washer for a tightening structure for locking, in which a thickness of the material of the washer is smaller than the pitch of the screwing part of the bolt, is provided.

BRIEF EXPLANATION OF DRAWING

[0025] **FIG. 1** is a cross section of a main part of a tightening structure for locking according to the first example of the present invention and (a) is one before completing the tightening and (b) is one after completing the tightening.

[0026] **FIG. 2** is a nut for a tightening structure for locking according to the first example of the present invention and (a) is top plan view and (b) is A-A cross section and (c) is bottom plan view.

[0027] **FIG. 3** is a washer for a tightening structure for locking according to the first example of the present invention and (a) is top plan view and (b) is B-B cross section.

[0028] **FIG. 4** is a part perspective view showing the state of the twisting of the washer in the contact point on the screwing point after completing tightening in a tightening structure for locking according to the first example of the present invention.

[0029] **FIG. 5** is a washer for a tightening structure for locking according to the second example of the present invention and (a) is top plan view and (b) is C-C cross section.

[0030] **FIG. 6** is a part cross section of a tightening structure for locking according to the other example of the present invention and (a) shows a case that an angle of the sloping part of the recessed part of a nut is a little larger than an angle of the sloping part of the projected part and (b) shows a case that an angle of the sloping part of the recessed part of a nut is a little smaller than an angle of the sloping part of the projected part and (c) shows a case that an angle of the sloping part of the recessed part of a nut is the same as an angle of the sloping part of the projected part

BEST EMBODIMENT FOR PERFORMING INVENTION

[0031] Embodiments of the present invention will be described based on examples, with reference to the drawings.

[0032] **FIG. 1** is a cross section of a main part of a tightening structure for locking according to the first example of the present invention and (a) is one before completing the tightening and (b) is one after completing the tightening. A tightening structure for locking according to the first example of the present invention mainly consists of bolt **4**, nut **2**, and washer **3**, and **5** and **6** show tightened objects. Bolt **4** consists of an axis **41** and a top part **42**. One of the points of a tightening structure for locking **1** according to the first example of the present invention lies in comprising a recessed part **21** symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed in the nut **2** on an inner washer **3** side and a projeted part **31** symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed on the washer **3** on an inner nut **2** side.

[0033] Next, the structure of a nut **2** for a tightening structure for locking according to the first example of the present invention is explained in more detail with reference to the **FIG. 2**. **FIG. 2** is a nut for a tightening structure for locking according to the first example of the present invention and (a) is top plan view and (b) is A-A cross section and (c) is bottom plan view. As shown in the A-A cross section in the **FIG. 2** (*b*), the female screwing part **26** is formed in the upper side of the inner side of the nut **2**, for adapting to the male screwing part formed in the axis of the bolt. A recessed part **21** is formed symmetrically with respect to the axis and formed in a generally trapezoidal shape in cross section in the nut **2** on an inner washer side. Herein, "symmetrically with respect to the axis" means "symmetrically with respect to the center axis T of the nut **2**."

[0034] The recessed part **21** mainly consists of a sloping part **22**, a lower crossing point **25** which is positioned in the crossing point between the sloping part **22** and the lower surface **28**, an upper surface part **25**, and an upper crossing point **24** which is positioned in the crossing point between the upper surface part **23** and the sloping part **22**. In this way, as a recessed part **21** is formed symmetrically with respect to the axis and formed in a generally trapezoidal shape in cross section in the nut, the upper crossing points **24** and the lower crossing points **25** are expressed as concentric circles, as shown in the bottom plan view in **FIG. 2**(*c*). And **27** is an inner diameter of the female screwing part **26** and is concentric circle, just the same way as the upper crossing points **24** and the lower crossing points **25**, as shown in **FIG. 2**(*c*).

[0035] Next, the detailed relation of the measure of this nut **2** is explained. V shows the distance between two sides

confronting each other in the regular hexagon (this distance, hereinafter, is refered to as "two sides width."), as an external form of the nut **2** in this embodiment is a regular hexagon in the bottom plan view in **FIG. 2**(*c*). D, D', D" each shows the outer diameter of the female screwing part **26**, the diameter of the upper crossing points **24**, and the diameter of the lower crossing points **25**. The relation of the measure among these four measures such as V, D, D', and D" is as follows.

$$D<D'<D"<=V$$

[**0036**] That is, the outer diameter D of the female screwing part **26**, the diameter D' of the upper crossing points **24**, the diameter D" of the lower crossing points **25**, and two sides width V, in this sequence, become longer and longer. But the diameter D" of the lower crossing points **25** can be equal to the two sides width V.

[**0037**] H, S, and H' respectively show the height of the nut, the height of the female screwing part **26**, and the height of the recessed part **21**. The relation of the measure among these three measures is as follows.

$$H=S+H'$$

[**0038**] The height S of the female screwing part **26** has to be longer than the length for which the necessary torque for tightening can be achieved. Moreover, approximately, the ratio between these two heights S:H=2:1 is preferable.

[**0039**] "x" shows a sloping angle of the sloping part **22** with respect to the center axis T and approximately **10** degree with respect to the center axis is preferable.

[**0040**] Next, the structure of the washer **3** for a tightening structure for locking according to the first example of the present invention is in more detail explained, with reference to the **FIG. 3**. **FIG. 3** is a washer for a tightening structure for locking according to the first example of the present invention and (a) is top plan view and (b) is B-B cross section.

[**0041**] One point of washer **3** for a tightening structure for locking according to the first example of the present invention lies in that a projected part **31** is provided and lies in the form of the projected part **31**. The projected part **31** mainly consists of the curved lower point **34**, the curved part **36** and the hole **35** and is formed in a generally trapezoidal shape in cross section. The curved lower point **34** constitutes a symmetrical form which makes the center position of the projected part **31** its center, that is, a circle, as shown in the top plan view of **FIG. 3**(*a*). The center position of this projected part **31** lies in "i" on the shown line X-X and the line X-X shown in this **FIG. 3**(*b*) is common with the center axis T of the nut **2** in the above-mentioned **FIG. 2** (*c*).This first example of the present invention comprises a supporting part **32** beneath the projected part **31** and the supporting part **32** can contact an tightened object etc. at the supporting lower point **33**.

[**0042**] The outer diameter point **37** of the hole **35** which is positoined at the upper side of the projected part **31**, constitutes a circle and the center position of this circle, that is, the center position of the hole **35** lies in the shown point "j." In this way, the center position "j" of the hole **35** is on the shown line Y-Y and the center position of the projected part **31** lies in "i" on the shown line X-X. The center position "j" of the hole **35** is eccentric to the center position "i" of the projected part **31**. That is, the position of the center position "j" of the hole **35** is different from the position of the center position "i" of the projected part **31**.

[**0043**] Next, the relation of the measure of the washer **3** for a tightening structure for locking according to the first example of the present invention is explained. As shown in B-B cross section in **FIG. 3**(*b*), h, h', and h" respectively show the height of the washer **3**, the height of the projected part **31**, and the supporting part **32**. The relation among these three values such as h, h', and h" is as follows.

$$h=h'+h"$$

[**0044**] In this embodimemt, H>h, that is, the height:H of the nut **2** is higher than the height:h of the washer **3**.

[**0045**] In the B-B cross section in **FIG. 3** (*b*), d, p, p', and p" respectively show the diameter of the hole **35**, the diameter of the circle consisting of the supporting lower points **33**, the diameter of the circle consisting of the most heighted points of the curved part **36** in the projected part **31**, and the diameter of the circle consisting of the curved lower points **34**. The relation between these four values d, p, p', and p" and the outer diameter D of the female screwing part **26** of the nut **2** in **FIG. 2**(*b*) is as follows.

$$p>p">p'>d>D$$

[**0046**] That is, the diameter:p of the circle consisting of the supporting lower points **33**, the diameter:p" of the circle consisting of the curved lower points **34**, the diameter:p' of the circle consisting of the most heightened points of the curved part **36** in the projected part **31**, and the outer diameter D of the female screwing part **26** of the nut **2**, in this sequence, become shorter and shorter. In this embodiment, $d=D+\alpha$, α shows the height of the ditch of the screwing part.

[**0047**] In the first example of the present invention, the relation among the diameter:p' of the circle consisting of the most heightened points of the curved part **36** in the projected part **31** of the washer **3**, the diameter:p" of the circle consisting of the curved lower points **34** in **FIG. 3**(*b*) and the diameter:D' of the upper crossing points **24** of the recessed part **21** of the nut **2**, the diameter D" of the lower crossing points **25**, is as follows.

$$p'<=D'<D"<=p"$$

[**0048**] That is, the diameter:p' of the circle consisting of the most heightened points of the curved part **36** in the projected part **31** of the washer **3**, is equal to or smaller than the diameter:D' of the upper crossing points **24** of the recessed part **21** of the nut **2** and the diameter:p" of the circle consisting of the curved lower points **34** in the curved part **36** in the projected part **31** of the washer **3**, is equal to or larger than the diameter D" of the lower crossing points **25** of the recessed part **21** of the nut **2**. As a result, in this first embodiment, when the recessed part **21** of the nut **2** and the projected part **31** of the washer **3** enter in the fitting state, the lower crossing points **25** of the recessed part **21** of the nut **2** applied the pressure around the curved part **36** in the projected part **31** of the washer **3**.

[**0049**] Next, operations of the above-written tightening structure for locking according to the first example of the present invention is explained, with reference to **FIG. 1**, **FIG. 2**, and **FIG. 3**.

[0050] As shown in **FIG. 1**(*a*), the tightened object **6** and the washer **3** according to this invention, in this order, are put on the top part **41** of the bolt **4** and the nut **2** according to this invention is rotated along the screwing part. First, the lower crossing points **25** of the recessed part **21** of the nut **2** gets in touch with the curved part **36** in the projected part **31** of the washer **3**.

[0051] The center position "i" of the projected part **31** is on "i" in the shown line X-X and the line X-X shown in this **FIG. 3**(*b*) is common with the center axis T of the nut **2** in the above-mentioned **FIG. 2**(*c*) so after the lower crossing points **25** of the recessed part **21** of the nut **2** gets in touch with the curved part **36** in the projected part **31** of the washer **3**, as shown in **FIG. 1**(*b*), the curved part **36** in the projected part **31** of the washer **3** enters along the recessed part **21** of the nut **2** with the result that the curved part **36** in the projected part **31** of the washer **3** and the recessed part **21** of the nut **2** enter into the fitting state.

[0052] At this time, because the center position "j" of the hole **35** of the projected part **31** of the washer **3** is eccentric to the center position "i" of the projected part **31**, as shown in the center-right side of **FIG. 1**(*b*), the parts consisting of the hole **35** of the projected part **31** of the washer **3**, cut into the screwing part of the axis **41** of the bolt **4**. That is, comparing (a) and (b) in **FIG. 1**, the washer **3** moves leftwards approximately only a distance corresponding to the ditch of the screwing part, in **FIG. 1**(*b*), with the result that the parts consisting of the hole **35** of the projected part **31** of the washer **3**, cut into the screwing part of the axis **41** of the bolt **4**.

[0053] As a result, after the nut **2** is tightened using the washer **3**, complex effect for locking can be achived because of so-called wedge effect. That is, because tightening torque acts as the force from the side against thescrewing part of the axis **41** of the bolt **4** by tightening of the nut **2**, the spcific part of the hole **35** of the washer **3** cuts into the screwing part of the axis **41** of the bolt **4** and the relation of the position between the washer **2** and the bolt **4** is fixed, with the result that the strong effect for locking can be achieved. In addition, it is preferable that a tightening structure for locking, wherein a thickness of the material of the washer is smaller than the pitch of the screwing part of the bolt, because the washer is easy to cut into the screwing part.

[0054] Moreover, because the screwing part of the axis **41** of the bolt is formed spirally, when the hole **35** of the washer **3** cuts into the spiral screwing part of the axis **41** of this bolt **4**, a kind of twist arises at the contact point with the screwing part of the hole **35**, as shown in the breif figure of **FIG. 4**. This kind of twist and the spiral screwing part arise the effect for locking.

[0055] Moreover, in the first embodiment, the washer **3** comoprises a supporting part **32** therebeneath. Therefore, the spring action of this supporting part **32** arises because of the tightening torque of the nut **2**. Because of this spring action, the inner side of the hole **35** of the washer **3** cuts into the screwing part of the axis **41** of the bolt **4**, with the result that the effect for locking appears strongly. Moreover, if the form of this supporting part is horizontal with respect to an tightened object, the specific effect that the washer is possible to move correctly horizontally, appears.

[0056] Moreover, in addition to the above-written effect for locking, because of the above-written wedge effect, the screwing part and the hole **35** of the washer **3** are strongly fitted and the concentrating power is applied to this fitting point, with the result that this fitting point becomes the key for locking. Therefore, even if the tightening torque is applied excessively, the break-down because of the excessive tightening, can be prevented and the proper tightening is possible.

[0057] **FIG. 5** is a washer **3** for a tightening structure for locking according to the second example of the present invention and (a) is top plan view and (b) is C-C cross section. The different point in comparison with a washer **3** for a tightening structure for locking according to the first example, lies in that the curved part **36** of the projected part **31** is changed into straight part in cross section. Therefore, as shown in **FIG. 6**(*a*), the lower crossing point **25** of the bolt contacts with the straight part in cross section in the projected part of the washer **3**. The form of the projected part can be varied by the materials etc. of nut or washer.

[0058] As other embodiment, as shown in **FIG. 6**(*b*), the projected part of the washer **3** has large sloping, with the result that the upper top part **38** of the projected part can contact with the sloping part **22** of the recessed part **21** of the nut **2**.

[0059] Moreover, as the other embodiment, as shown in **FIG. 6**(*c*), an angle of the sloping part of the recessed part of a nut is the same as an angle of the sloping part of the projected part, with the result that the face-contact is possible.

[0060] As described above, tightening structure for locking and nut and washer for the tightening structure can make more firm tightening possible.

INDUSTRIAL APPLICABILITY

[0061] As a tightening structure for locking according to this invention, comprising a nut, a bolt, and a washer with a hole through which an axis of said bolt passes, wherein, a recessed part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed in the nut on an inner washer side, a projeted part symmetrical with respect to the axis and formed in a generally trapezoidal shape in cross section is formed on the washer on an inner nut side, and the recessed part of the nut is fitted to the projected part of said washer, and the hole in the washer is positioned on the inner side of the projected part and the center position of the hole is positioned eccentric to the center position of the projected part of the washer, this is useful for locking of the tightening structure.

Claim of invention:

1. A tightening structure for locking, comprising a nut, a bolt, and a washer with a hole through which an axis of said bolt passes, wherein, a recessed part symmetrical with respect to said axis and formed in a generally trapezoidal shape in cross section is formed in said nut on an inner washer side, a projected part symmetrical with respect to said axis and formed in a generally trapezoidal shape in cross section is formed on said washer on an inner nut side, and said recessed part of said nut is fitted to said projected part of said washer, and said hole in said washer is positioned on the inner side of said projected part and the center position of said hole is positioned eccentric to the center position of said projected part of said washer.

2. A nut for a tightening structure for locking, comprising a nut, a bolt, and a washer with a hole through which an axis of said bolt passes, wherein, a recessed part symmetrical with respect to said axis and formed in a generally trapezoidal shape in cross section is formed in said nut on an inner washer side.

3. A washer for a tightening structure for locking comprising a nut, a bolt, and a washer with a hole through which an axis of said bolt passes, wherein, a projeted part symmetrical with respect to said axis and formed in a generally trapezoidal shape in cross section is formed on said washer on an inner nut side, and said hole in said washer is positioned on the inner side of said projected part and the center position of said hole is positioned eccentric to the center position of said projected part of said washer.

4. A tightening structure for locking as set forth in claim 1, in which said recessed part of said nut is fitted to said projected part of said washer, wherein, said recessed part comprises an upper surface part and an sloping part, said projected part comprises an upper surface part and an sloping part, a form of the fitting is that said sloping part of said recessed part is formed in plane form and said sloping part of said projected part is formed in curved form.

5. A tightening structure for locking as set forth in claim 1, in which said recessed part of said nut is fitted to said projected part of said washer, wherein, said recessed part comprises an upper surface part and an sloping part, said projected part comprises an upper surface part and an sloping part, a form of the fitting is that an angle of said sloping part of said recessed part is a little larger than an angle of said sloping part of said projected part.

6. A tightening structure for locking as set forth in claim 1, in which said recessed part of said nut is fitted to said projected part of said washer, wherein, said recessed part comprises an upper surface part and an sloping part, said projected part comprises an upper surface part and an sloping part, a form of the fitting is that an angle of said sloping part of said recessed part is a little smaller than an angle of said sloping part of said projected part.

7. A tightening structure for locking as set forth in claim 1, in which said recessed part of said nut is fitted to said projected part of said washer, wherein, said recessed part comprises an upper surface part and an sloping part, said projected part comprises an upper surface part and an sloping part, a form of the fitting is that an angle of said sloping part of said recessed part is the same as an angle of said sloping part of said projected part.

8. A nut for a tightening structure for locking set forth in claim 3, in which said projected part is formed in curved form.

9. A tightening structure for locking as set forth in claim 1, in which said projected part of said washer has a supporting part therebeneath.

10. A washer for a tightening structure for locking as set forth in claim 3, in which said projected part has a supporting part therebeneath.

11. A tightening structure for locking as set forth in claim 9, in which said supporting part is horizontal with respect to an tightened object.

12. A washer for a tightening structure for locking as set forth in claim 10, in which said supporting part is horizontal with respect to an tightened object.

13. A tightening structure for locking as set forth in claim 1, in which the ratio between a height of the female screwing part and a height of said recessed part in said nut is approximately 2 to 1.

14. A nut for a tightening structure for locking as set forth in claim 2, in which the ratio between a height of the female screwing part and a height of said recessed part in said nut is approximately 2 to 1.

15. A tightening structure for locking as set forth in claim 1, in which a sloping angle of said sloping part in said nut is approximately 10 degree with respect to the center axis.

16. A nut for a tightening structure for locking as set forth in claim 2, in which a sloping angle of said sloping part in said nut is approximately 10 degree with respect to the center axis.

17. A tightening structure for locking as set forth in claim 1, **4**, **5**, **6**, **7**, **9**, **11**, **13**, or **15**, wherein a diameter of a circle consisting of the most heightened points of said sloping part of said projected part of said washer, is equal to or smaller than an diameter of the upper crossing points of said recessed part of said nut and a diameter of a circle consisting of the lower points of said sloping part of said projected part of said washer, is equal to or larger than an diameter of the lower crossing points of said recessed part of said nut.

18. A tightening structure for locking as set forth in claim 1, **4**, **5**, **6**, **7**, **9**, **11**, **13**, **15**, or **17**, wherein a diameter of said hole of said washer is higher than a outer diameter of said female screwing part by the height of the ditch of the female screwing part of said nut.

19. A tightening structure for locking as set forth in claim 1, **4**, **5**, **6**, **7**, **9**, **11**, **13**, **15**, **17**, or **18**, wherein said nut is higher than said washer.

20. A tightening structure for locking as set forth in claim 1, **4**, **5**, **6**, **7**, **9**, **11**, **13**, **15**, **17**, **18**, or **19**, wherein a thickness of the material of said washer is smaller than the pitch of said screwing part of said bolt.

21. A washer for a tightening structure for locking as set forth in claim 3 or **10**, in which a thickness of the material of said washer is smaller than the pitch of said screwing part of said bolt.

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