US 20140186134A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2014/0186134 A1

(43) Pub. Date: Jul. 3, 2014

Lin

(54) SELF-LOCKING NUT ASSEMBLY

(71) Applicant: Chen-Mao Lin, (US)

(72) Inventor: Chen-Mao Lin, (US)

(21) Appl. No.: 13/733,357

(22) Filed: Jan. 3, 2013

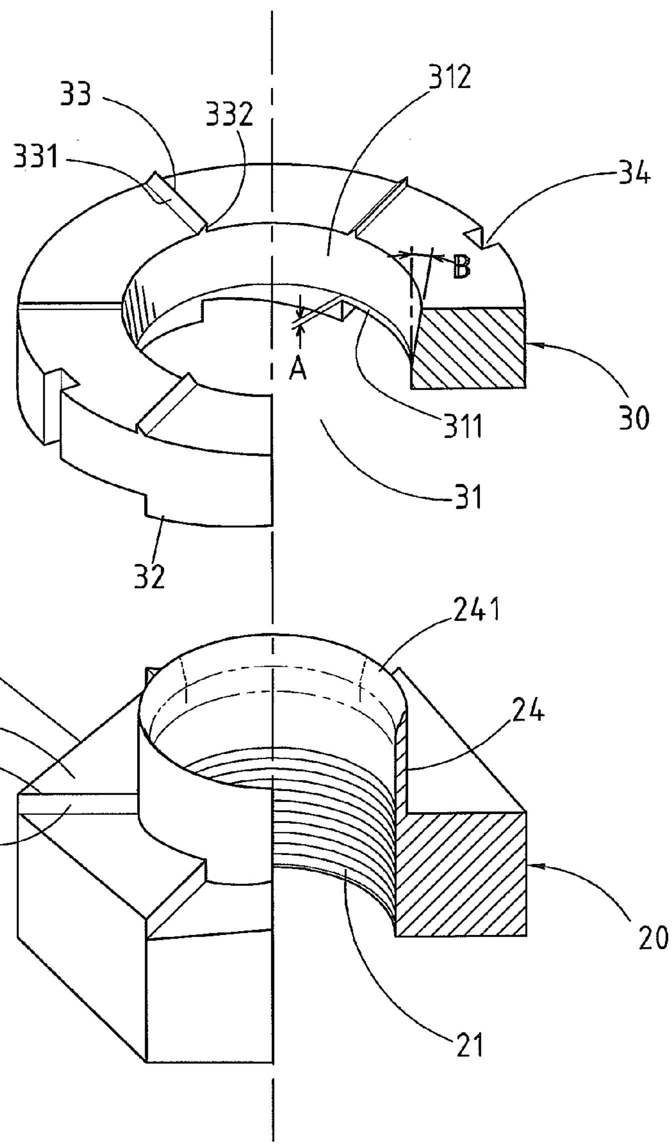
Publication Classification

(51) Int. Cl.
F16B 39/24 (2006.01)

(52) U.S. Cl.
CPC *F16B 39/24* (2013.01)
USPC 411/204

(57) ABSTRACT

A self-locking nut assembly includes a nut, and a washer connected with the nut. The nut has a screw bore and a protruding conical ring. The washer has a central portion provided with a conical hole which includes a limit section and an annular tapered section. The conical ring is extended through the conical hole. The conical ring of the nut has a distal portion provided with an annular opening which is enlarged and expanded outward to form a protruding flange. The protruding flange is limited by the limit section of the conical hole. Thus, a determined clearance is defined between the conical ring of the nut and the conical hole of the washer, so that the nut and the washer have determined axial and radial gaps, and the washer can be rotated freely.



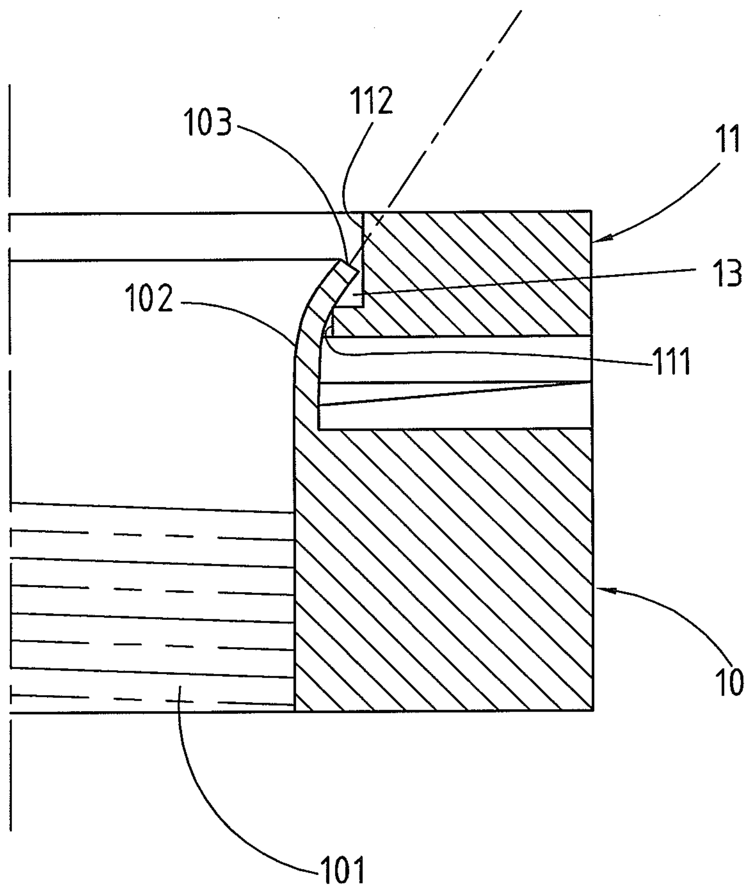


FIG. 1
PRIOR ART

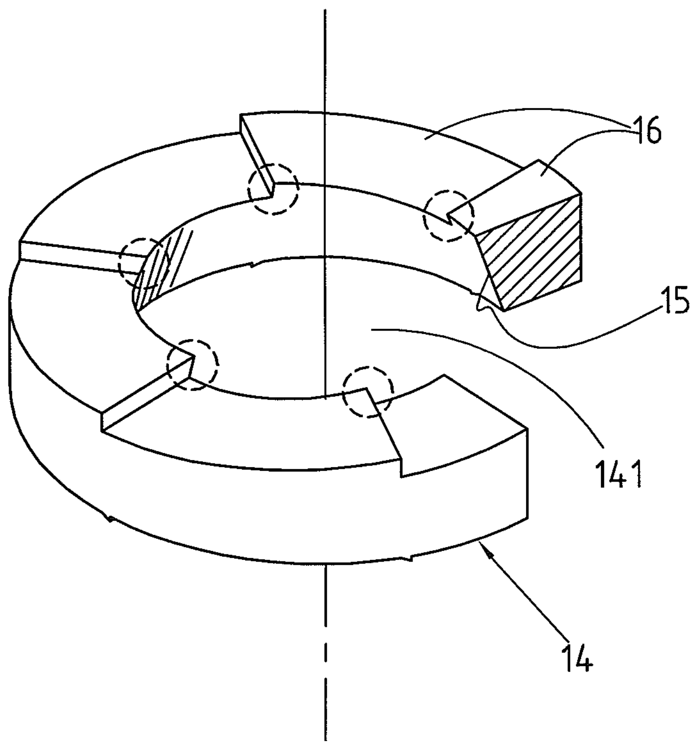


FIG. 2
PRIOR ART

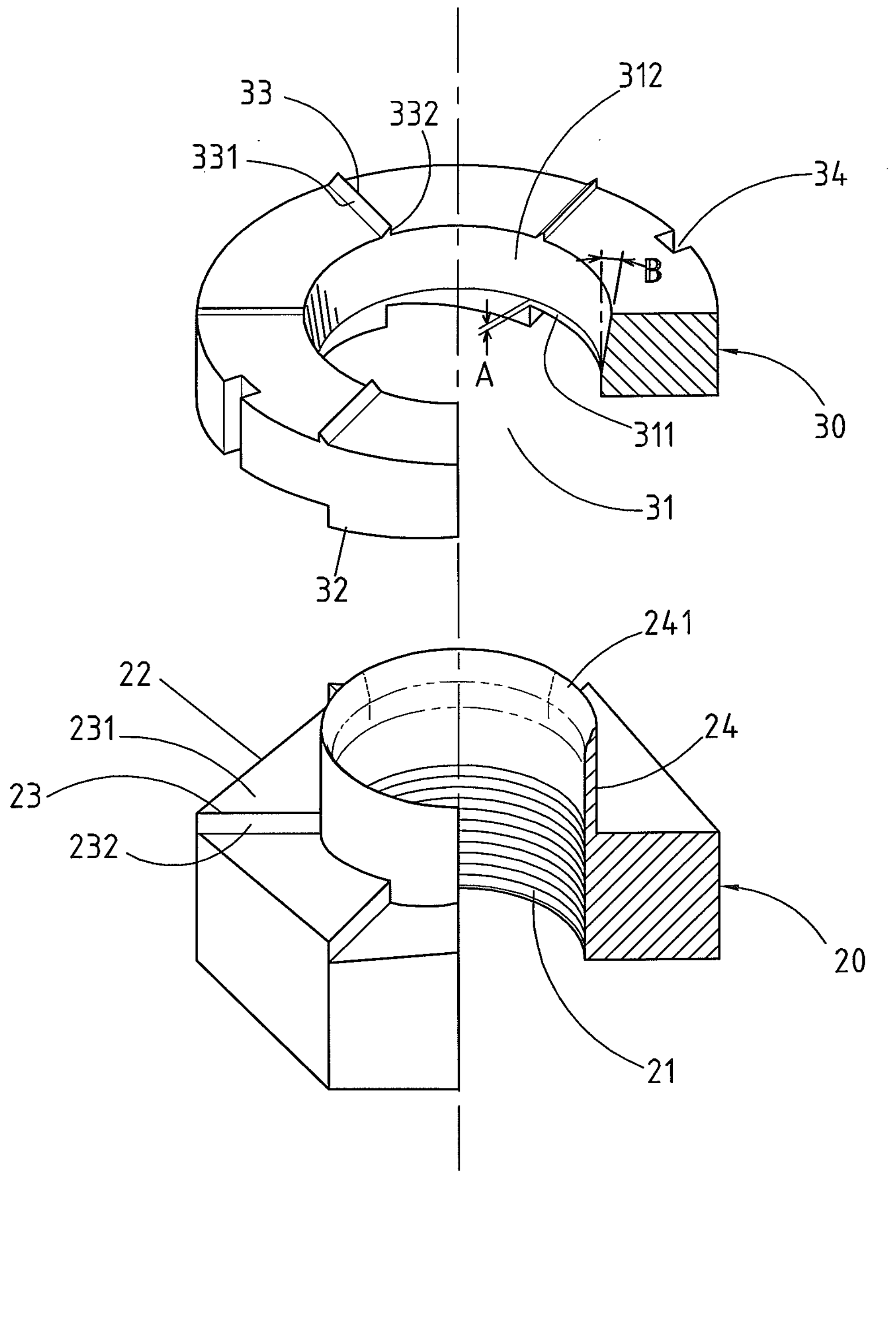


FIG. 3

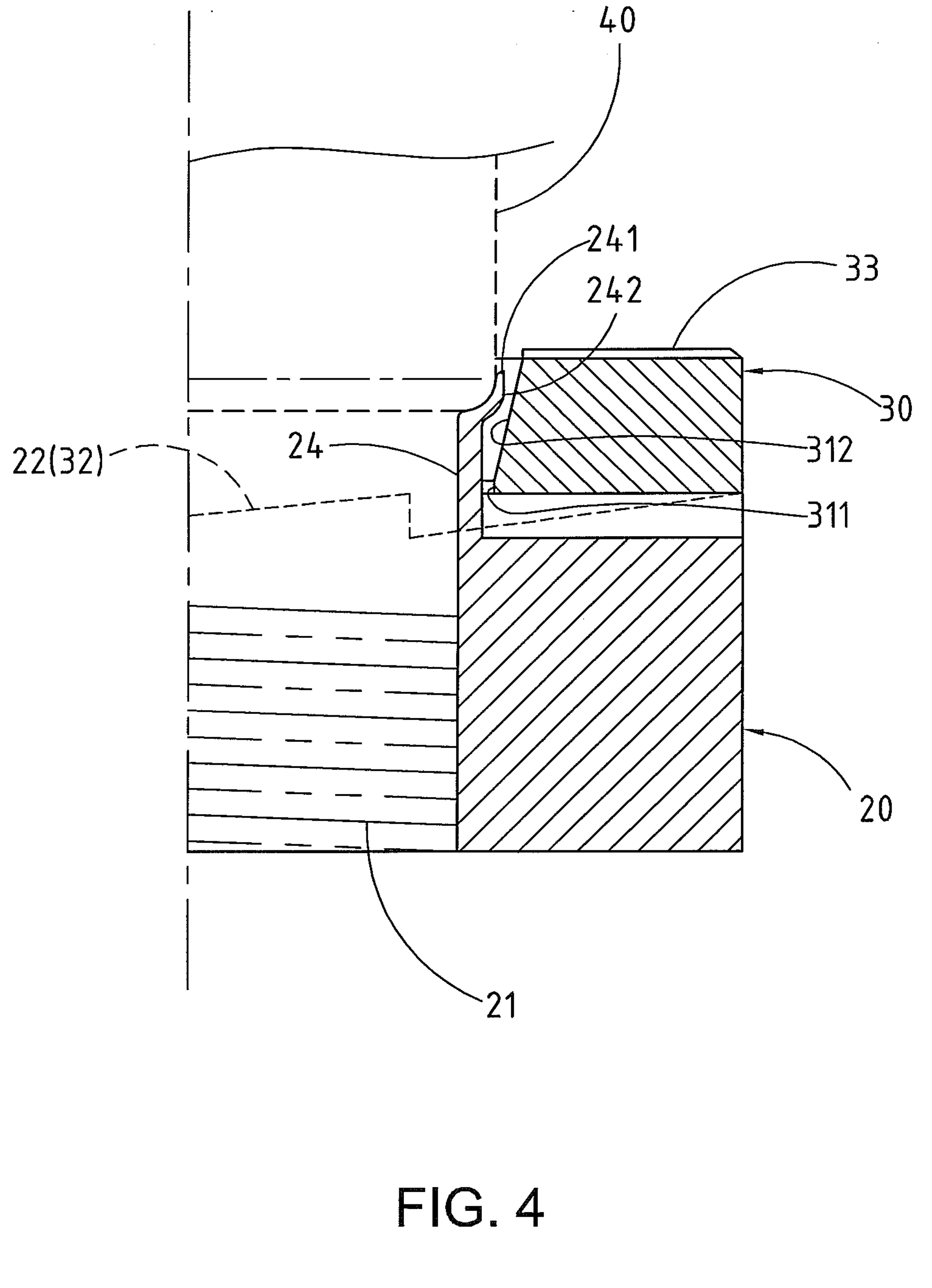


FIG. 4

SELF-LOCKING NUT ASSEMBLY

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a nut and washer assembly and, more particularly, to a self-locking nut assembly.

[0003] 2. Description of the Related Art

[0004] A conventional self-locking nut assembly in accordance with the prior art shown in FIG. **1** comprises a nut **10**, and a washer **11** connected with the nut **10**. The nut **10** has a screw bore **101**. The screw bore **101** of the nut **10** has a periphery provided with an annular portion **102**. The annular portion **102** of the nut **10** has a distal end provided with an annular opening **103**. The washer **11** has a central hole **111** which is greater than the annular portion **102** of the nut **10**. The central hole **111** of the washer **11** has a periphery provided with an annular groove **112** greater than the central hole **111**. A clearance **13** is defined between the annular opening **103** of the nut **10**, and the annular groove **112** and the central hole **111** of the washer **11**. The annular portion **102** of the nut **10** is initially extended through the central hole **111** of the washer **11**. Then, a plunger of a stamping die is inserted into the annular opening **103** of the nut **10** to expand and enlarge the annular opening **103** of the nut **10** so that the annular opening **103** of the nut **10** has a size grater than the diameter of the central hole **111** of the washer **11**. Thus, the washer **11** is limited by the annular opening **103** of the nut **10** so that the washer **11** is combined with the nut **10** and will not be detached from each other. However, the annular opening **103** of the nut **10** is expanded outward so that the clearance **13** between the annular opening **103** of the nut **10**, and the annular groove **112** and the central hole **111** of the washer **11** is shortened to limit the radial movable space of the washer **11**. In addition, the annular opening **103** of the nut **10** is easy to press the annular groove **112** of the washer **11**, so that the washer **11** is locked and cannot be rotated. Further, when the annular opening **103** of the nut **10** is expanded outward, the flat tubular portion of the annular portion **102** is shortened, so that the axial movable space of the washer **11** is shortened.

[0005] Referring to FIG. **2** with reference to FIG. **1**, the washer **14** has a central hole **141** which has a peripheral wall provided with a tapered face **15**. The washer **14** has a side provided with a plurality of wedge-shaped teeth **16**. Thus, the tapered face **15** of the washer **14** will not be locked by the annular opening **103** of the nut **10**, so that the washer **11** is not locked and can be rotated freely. Each of the wedge-shaped teeth **16** of the washer **14** is a spatial inclined face with a thickness variation. Thus, by provision of the tapered face **15**, the minimum diameter of the central hole **141** is located at the thickest portion of each of the wedge-shaped teeth **16**, so that only the thickest portion of each of the wedge-shaped teeth **16** has a determined axial restriction effect as indicated by the phantom circles. However, when the relative angle between the annular opening **103** of the nut **10** and the washer **14** is deflected slightly, the annular opening **103** of the nut **10** is easily passed through the connection between the wedge-shaped teeth **16** of the washer **14** and is detached from the washer **14**, so that the nut **10** will be detached from the washer **14**.

BRIEF SUMMARY OF THE INVENTION

[0006] In accordance with the present invention, there is provided a self-locking nut assembly, comprising a nut, and a washer connected with the nut. The nut has a screw bore. The nut has a bottom provided with a first wedge-shaped portion. The first wedge-shaped portion of the nut includes at least one oneway wedge-shaped tooth. The washer has a central portion provided with a conical hole. The washer has a top provided with a second wedge-shaped portion having a shape matching that of the first wedge-shaped portion of the nut. The washer has a bottom provided with a plurality of protruding bars which are arranged in a radiating manner. The nut has a periphery provided with a protruding conical ring located between the first wedge-shaped portion and the screw bore. The conical hole of the washer includes a limit section and an annular tapered section. The limit section of the conical hole has a diameter slightly greater than an outer diameter of the conical ring of the nut. The second wedge-shaped portion of the washer has at least one oneway wedge-shaped tooth. The limit section of the conical hole extends from a bottom of the oneway wedge-shaped tooth of the second wedge-shaped portion toward the bottom of the washer, and has a determined thickness. The annular tapered section of the conical hole is inclined relative to and extended outward from the limit section and has a tapered angle relative to an axis of center of the conical hole. The conical ring of the nut is extended through the conical hole of the washer. The conical ring of the nut has a distal portion provided with an annular opening. The annular opening of the conical ring has a periphery provided with a protruding flange. The annular opening of the conical ring is enlarged and expanded outward to form the protruding flange. The protruding flange of the conical ring has a size greater than a diameter of the conical hole of the washer. The protruding flange of the conical ring is limited by the limit section of the conical hole.

[0007] The washer has a circular shape. Alternatively, the washer has a hexagonal shape. The thickness of the limit section has an optimum value ranged between 0.1 mm and 0.3 mm. The tapered angle of the annular tapered section has an optimum value ranged between 25° and 35°. The conical ring of the nut has a constant outer diameter. The conical ring of the nut has a root portion whose thickness is greater than that of the annular opening. The outer diameter of the protruding flange is disposed at a vertical state. The conical ring has an upright and flat outer portion under the protruding flange.

[0008] The primary objective of the present invention is to provide a self-locking nut assembly whose nut and washer will not interfere with each other.

[0009] According to the primary advantage of the present invention, a determined clearance is defined between the conical ring of the nut and the conical hole of the washer, so that the nut and the washer have determined axial and radial gaps, and the washer can be rotated freely.

[0010] Further benefits and advantages of the present invention will become apparent after a careful reading of the detailed description with appropriate reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0011] FIG. **1** is a front cross-sectional assembly view of a conventional self-locking nut assembly in accordance with the prior art.

[0012] FIG. **2** is a partially perspective cross-sectional view of a washer of another conventional self-locking nut assembly in accordance with the prior art.

[0013] FIG. **3** is an exploded perspective view of a self-locking nut assembly in accordance with the preferred embodiment of the present invention.

[0014] FIG. **4** is a front cross-sectional assembly view of the self-locking nut assembly as shown in FIG. **1**.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Referring to FIGS. **3** and **4**, a self-locking nut assembly in accordance with the preferred embodiment of the present invention comprises a nut **20**, and a washer **30** connected with the nut **20**.

[0016] The nut **20** has a hexagonal shape and has a central portion provided with a screw bore **21**. The nut **20** has a bottom provided with a first wedge-shaped portion **22**. The first wedge-shaped portion **22** of the nut **20** includes at least one oneway wedge-shaped tooth **23**. The oneway wedge-shaped tooth **23** of the first wedge-shaped portion **22** includes a ramp **231** and a vertical catch face **232**. The ramp **231** of the oneway wedge-shaped tooth **23** has an outer edge and an inner edge. The outer edge and the inner edge of the ramp **231** have the same height at the same central angle. The nut **20** has a periphery provided with a protruding conical ring **24** located between the first wedge-shaped portion **22** and the screw bore **21**. The conical ring **24** of the nut **20** has a cross-sectional profile with the same outer diameter. The conical ring **24** of the nut **20** has a distal portion provided with an annular opening **241**. The conical ring **24** of the nut **20** has an inner conical shape and has a root portion whose thickness is greater than that of the annular opening **241**. The annular opening **241** of the conical ring **24** has a periphery provided with a protruding flange **242**.

[0017] The washer **30** has a top provided with a second wedge-shaped portion **32** having a shape matching that of the first wedge-shaped portion **22** of the nut **20**. The washer **30** has a bottom provided with a plurality of protruding bars **33** which are arranged in a radiating manner. Each of the protruding bars **33** of the washer **30** includes an oblique wall **331** and a vertical wall **332**. The oblique wall **331** of each of the protruding bars **33** is arranged in a screwing direction of the nut **20**. The washer **30** has a central portion provided with a conical hole **31**. The conical hole **31** of the washer **30** includes a limit section **311** and an annular tapered section **312**. The limit section **311** of the conical hole **31** has a diameter slightly greater than an outer diameter of the conical ring **24** of the nut **20** as shown in FIG. **4**. The second wedge-shaped portion **32** of the washer **30** has at least one oneway wedge-shaped tooth. The limit section **311** of the conical hole **31** extends from a bottom of the oneway wedge-shaped tooth of the second wedge-shaped portion **32** toward the bottom of the washer **30**, and has a determined thickness "A". The annular tapered section **312** of the conical hole **31** is inclined relative to and extended outward from the limit section **311** and has a tapered angle "B" relative to an axis of center of the conical hole **31**. Preferably, the thickness "A" of the limit section **311** has an optimum value ranged between 0.1 mm and 0.3 mm, and the tapered angle "B" of the annular tapered section **312** has an optimum value ranged between 25° and 35°, so that the nut **20** and the washer **30** are connected in an optimum manner. The washer **30** has a circular shape and has an outer periphery provided with at least one slot **34** to allow insertion of a special tool. Alternatively, the washer **30** has a hexagonal shape for operation of a normal hand tool.

[0018] In fabrication, the conical ring **24** of the nut **20** is extended through the conical hole **31** of the washer **30**. Then, a plunger **40** of a stamping die is inserted into the annular opening **241** of the conical ring **24** to enlarge the annular opening **241** of the conical ring **24** so as to form the protruding flange **242**. At this time, the annular opening **241** of the conical ring **24** has a determined thickness smaller than that of the root of the conical ring **24**, so that the annular opening **241** of the conical ring **24** is easily expanded outward to form the protruding flange **242**. In such a manner, the protruding flange **242** of the conical ring **24** has a size greater than a diameter of the conical hole **31** of the washer **30**, so that the protruding flange **242** of the conical ring **24** is limited by the limit section **311** of the conical hole **31**. Thus, the nut **20** and the washer **30** are combined together and will not be detached from each other.

[0019] Especially, the annular opening **241** of the conical ring **24** has a determined thickness smaller than that of the root of the conical ring **24**, so that the angle of the outer diameter of the protruding flange **242** can be contracted inward, and the outer diameter of the protruding flange **242** is disposed at a vertical state. In addition, the outer diameter of the conical ring **24** will not be expanded outward and enlarged so that the conical ring **24** has an upright and flat outer portion under the protruding flange **242**. Thus, a determined clearance is defined between the conical ring **24** of the nut **20**, and the limit section **311** and the annular tapered section **312** of the washer **30**, so that after the nut **20** and the washer **30** are combined together, the nut **20** and the washer **30** have determined axial and radial gaps, and the washer **30** can be rotated freely.

[0020] Accordingly, a determined clearance is defined between the conical ring **24** of the nut **20** and the conical hole **31** of the washer **30**, so that the nut **20** and the washer **30** have determined axial and radial gaps, and the washer **30** can be rotated freely.

[0021] Although the invention has been explained in relation to its preferred embodiment(s) as mentioned above, it is to be understood that many other possible modifications and variations can be made without departing from the scope of the present invention. It is, therefore, contemplated that the appended claim or claims will cover such modifications and variations that fall within the true scope of the invention.

1. A self-locking nut assembly, comprising:
a nut; and
a washer connected with the nut; wherein:
the nut has a screw bore;
the nut has a bottom provided with a first wedge-shaped portion;
the first wedge-shaped portion of the nut includes at least one oneway wedge-shaped tooth;
the washer has a central portion provided with a conical hole;
the washer has a top provided with a second wedge-shaped portion having a shape matching that of the first wedge-shaped portion of the nut;
the washer has a bottom provided with a plurality of protruding bars which are arranged in a radiating manner;
the nut has a periphery provided with a protruding conical ring located between the first wedge-shaped portion and the screw bore;
the conical hole of the washer includes a limit section and an annular tapered section;
the limit section of the conical hole has a diameter slightly greater than an outer diameter of the conical ring of the nut;

the second wedge-shaped portion of the washer has at least one oneway wedge-shaped tooth;

the limit section of the conical hole extends from a bottom of the oneway wedge-shaped tooth of the second wedge-shaped portion toward the bottom of the washer, and has a determined thickness;

the annular tapered section of the conical hole is inclined relative to and extended outward from the limit section and has a tapered angle relative to an axis of center of the conical hole;

the conical ring of the nut is extended through the conical hole of the washer;

the conical ring of the nut has a distal portion provided with an annular opening;

the annular opening of the conical ring has a periphery provided with a protruding flange;

the annular opening of the conical ring is enlarged and expanded outward to form the protruding flange;

the protruding flange of the conical ring has a size greater than a diameter of the conical hole of the washer; and

the protruding flange of the conical ring is limited by the limit section of the conical hole.

2. The self-locking nut assembly of claim **1**, wherein the washer has a circular shape.

3. The self-locking nut assembly of claim **1**, wherein the washer has a hexagonal shape.

4. The self-locking nut assembly of claim **1**, wherein the thickness of the limit section has an optimum value ranged between 0.1 mm and 0.3 mm.

5. The self-locking nut assembly of claim **1**, wherein the tapered angle of the annular tapered section has an optimum value ranged between 25° and 35°.

6. The self-locking nut assembly of claim **1**, wherein:

the conical ring of the nut has a constant outer diameter; and

the conical ring of the nut has a root portion whose thickness is greater than that of the annular opening.

7. The self-locking nut assembly of claim **1**, wherein:

the outer diameter of the protruding flange is disposed at a vertical state; and

the conical ring has an upright and flat outer portion under the protruding flange.

* * * * *