US 20040134301A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2004/0134301 A1

Ko et al. (43) Pub. Date: Jul. 15, 2004

(54) TILT ADJUSTING UNIT FOR STEERING COLUMNS

(75) Inventors: **Min Young Ko**, Wonju-Si (KR); **Jong Hoon Shin**, Gwangmyeong-Si (KR)

Correspondence Address:
Richard P. Borg
c/o LADAS & PARRY
Suite 2100
5670 Wilshire Boulevard
Los Angeles, CA 90036-5679 (US)

(73) Assignee: **MANDO CORPORATION**

(21) Appl. No.: **10/746,594**

(22) Filed: **Dec. 23, 2003**

(30) **Foreign Application Priority Data**

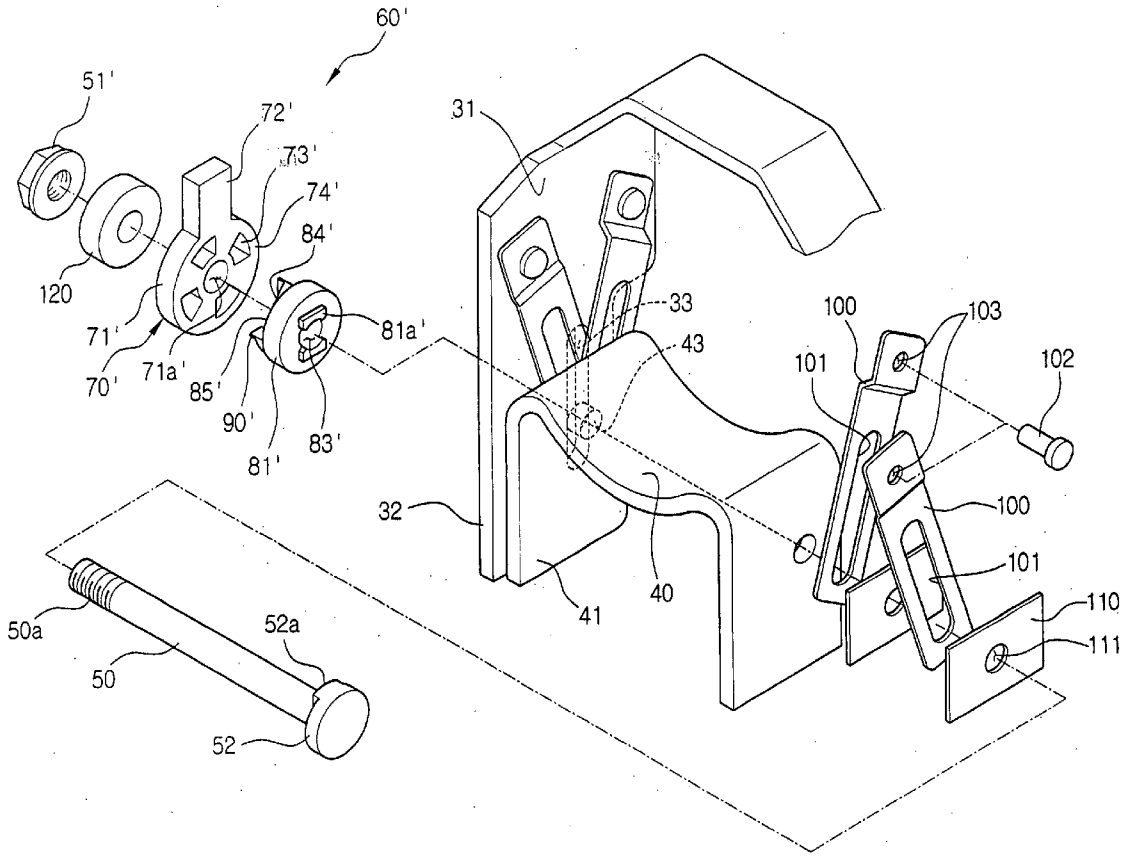
Jan. 6, 2003 (KR) P2003-528
Jan. 6, 2003 (KR) P2003-529
Jan. 6, 2003 (KR) P2003-530

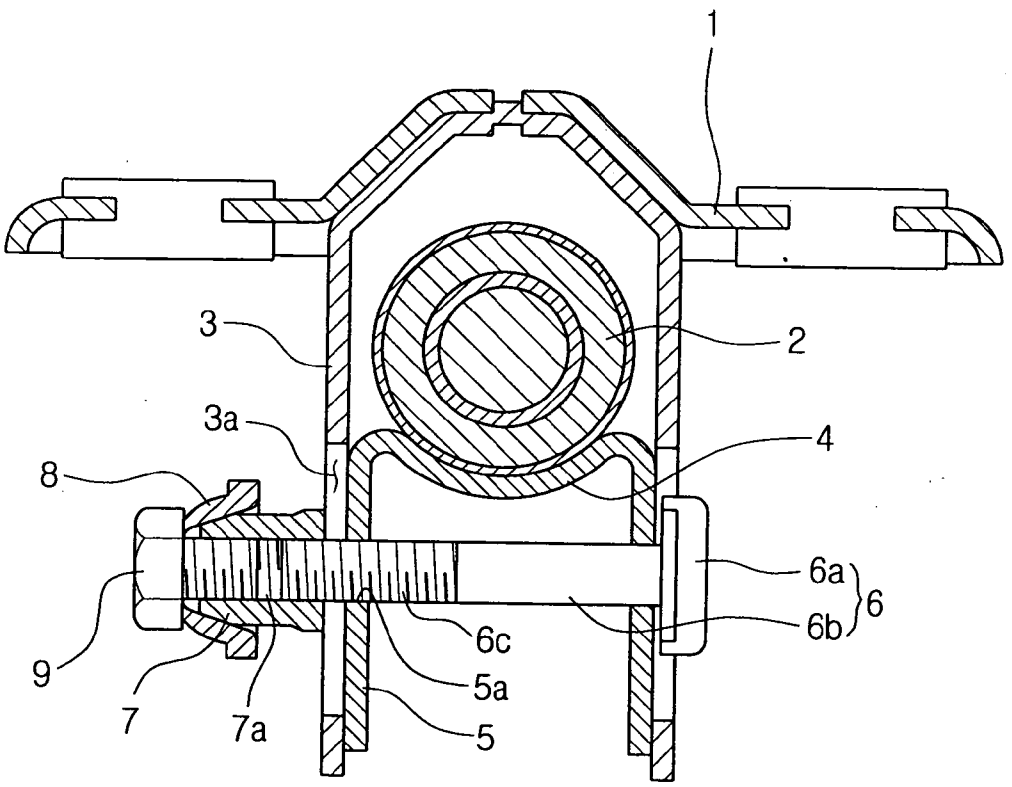
Publication Classification

(51) **Int. Cl.**[7] **B62D 1/16**
(52) **U.S. Cl.** **74/492**; 74/495

(57) **ABSTRACT**

A tilt adjusting unit for steering columns prevents a steering column from popping up due to an external impact. The tilt adjusting unit includes a support bracket mounted to a predetermined portion of a vehicle body. A steering column is mounted to a predetermined portion of the vehicle body to tilt relative to the vehicle body. A movable bracket tilts along with the steering column. A connection rod connects the movable bracket to the support bracket. A guide slot is formed on a predetermined portion of the support bracket along a tilting direction of the steering column, with the connection rod passing through the guide slot. A locking unit is provided on a predetermined portion of the connection rod to lock or unlock the movable bracket to or from the support bracket. A crossing plate is mounted to a predetermined portion of the support bracket to rotate around an end of the crossing plate, and has a crossing slot to cross the guide slot, thus allowing the connection rod to pass through both the guide slot and the crossing slot.

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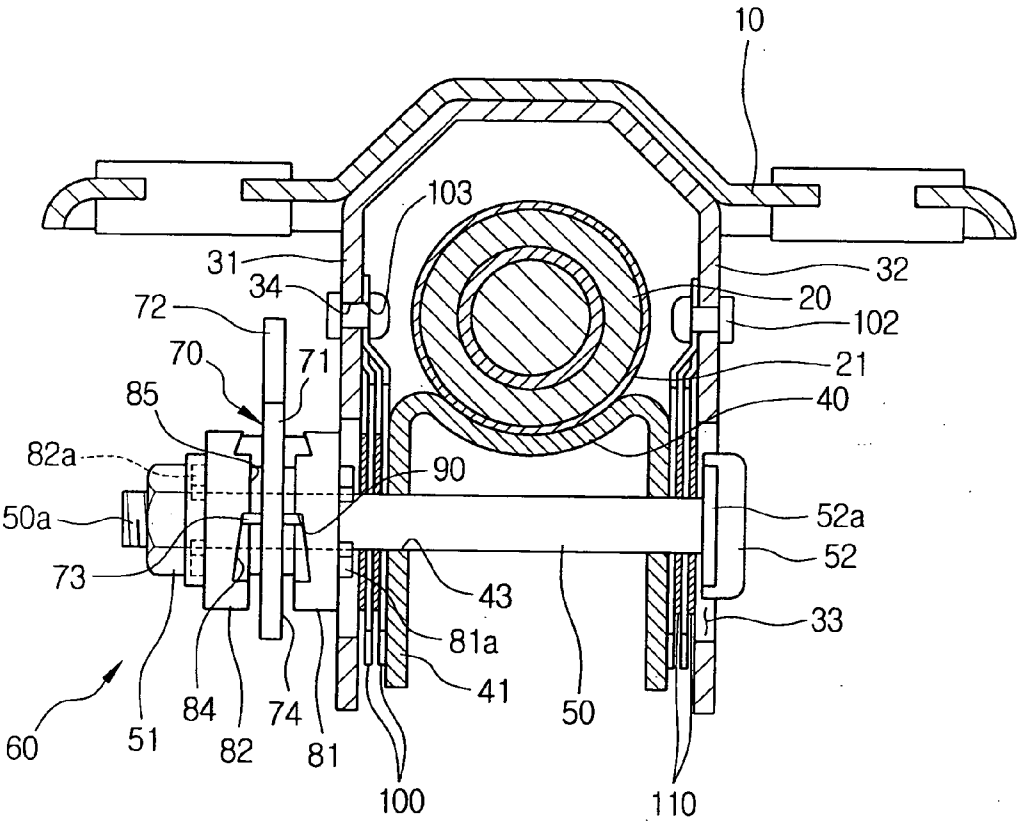
4
8
6a
6
6b
6c
9
5a
7
7a
5

FIG. 2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103
31
34
32
20
72
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71
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85
40
82a
90
50a
52a
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73
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33
81a
41
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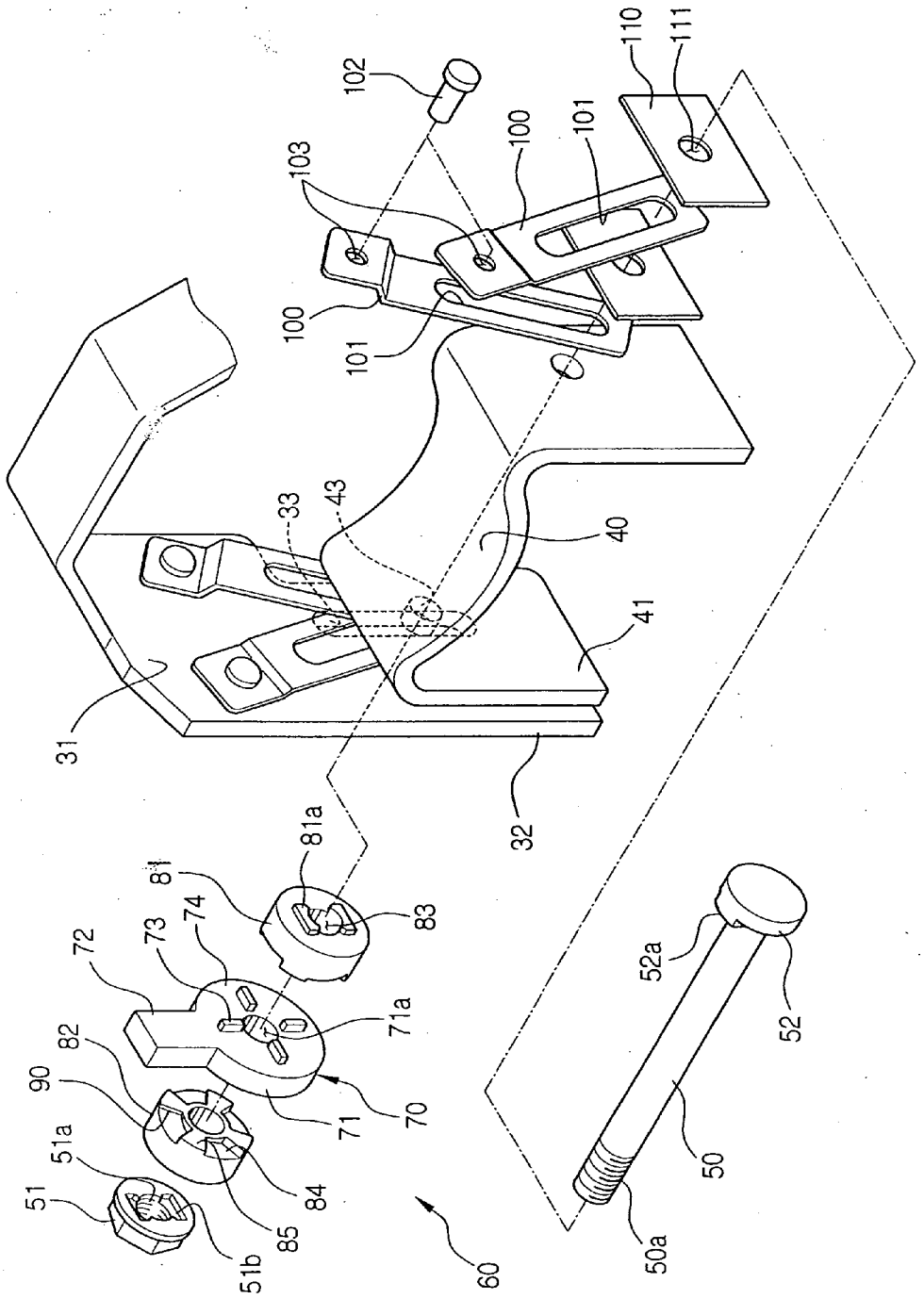
51
84
82
74
81
50
100
110

FIG. 3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111
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43
40
41
31
32
81a
81
83
74
73
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51a
51
84
85
51b
60
52a
52
50
50a

FIG. 4

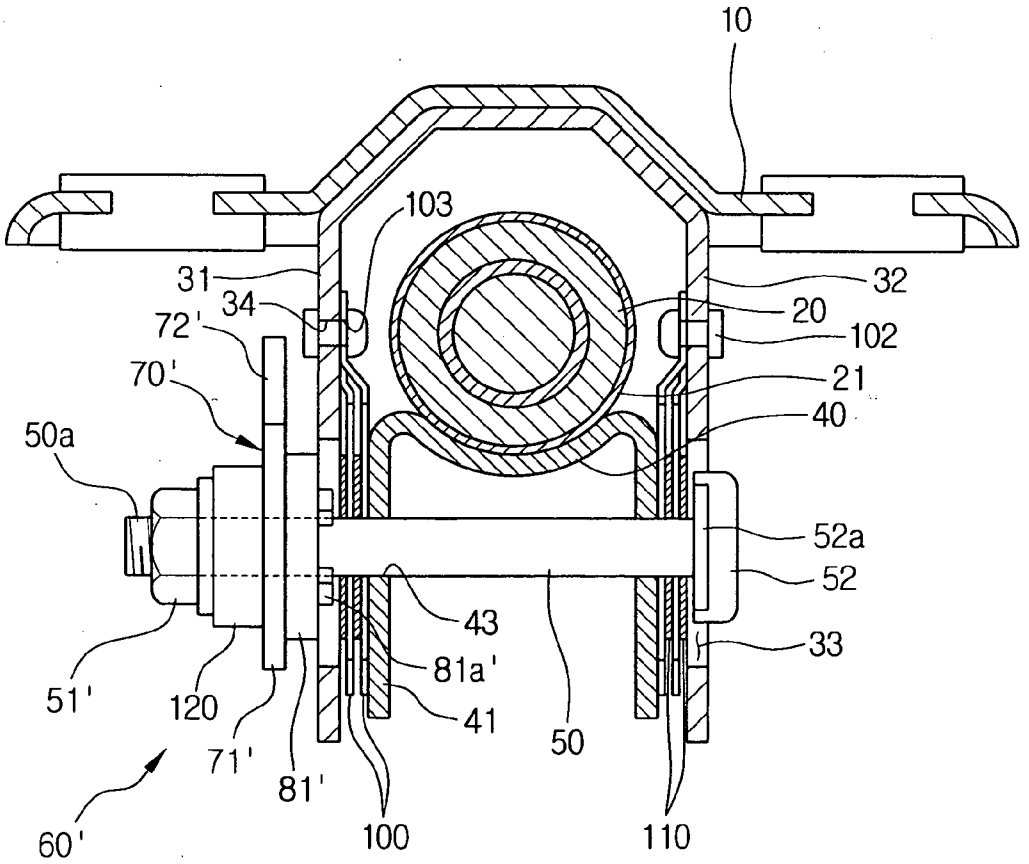
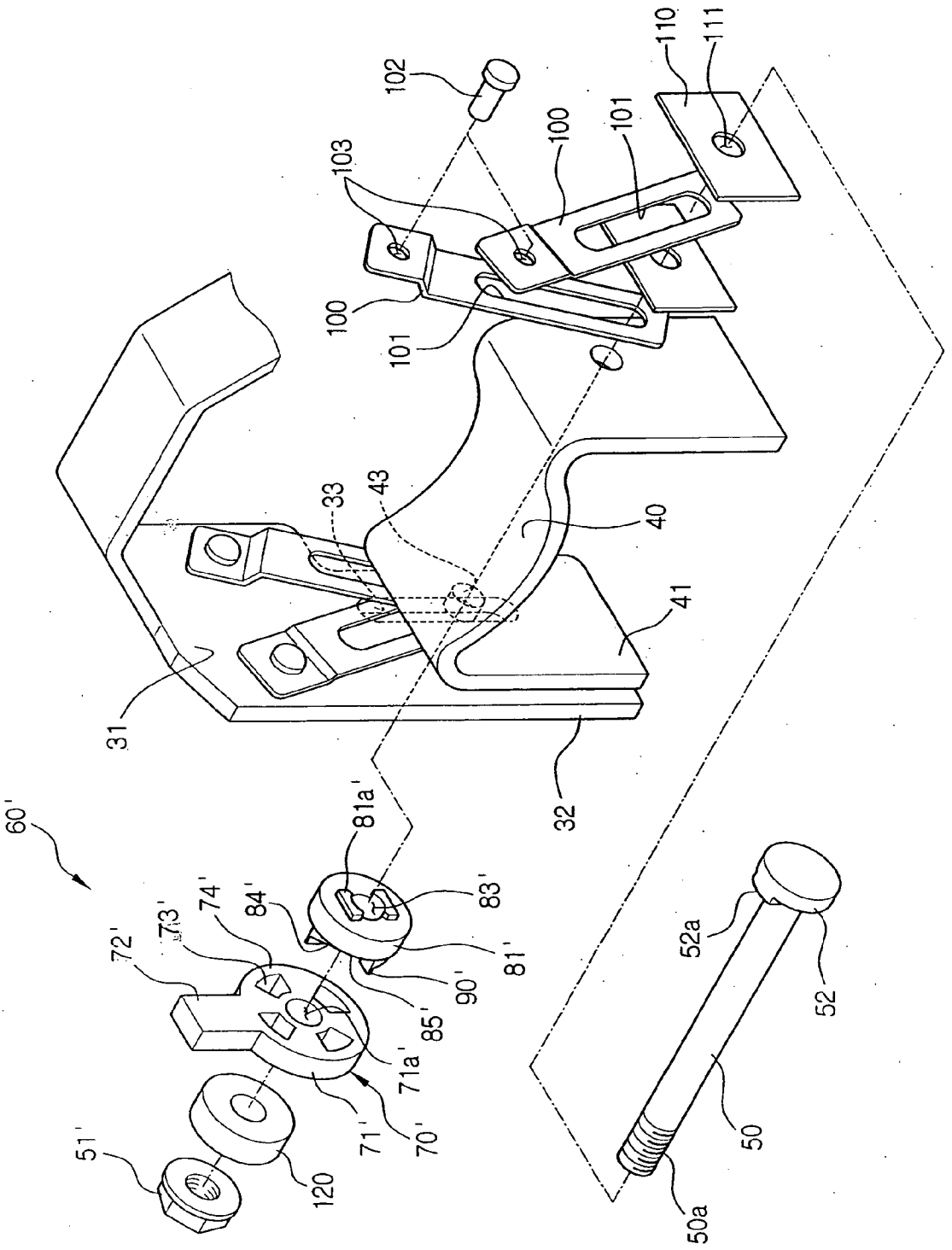

10
103
31
32
34
20
72'
102
70'
21
40
50a
52a
52
43
33
81a'
51'
120
41
50
71'
81'
60'
100
110

FIG. 5


102
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31
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60'
81a'
74'
84'
83'
73'
72'
81'
90'
85'
71a'
71'
70'
51'
120
52a
52
50
50a

FIG. 6

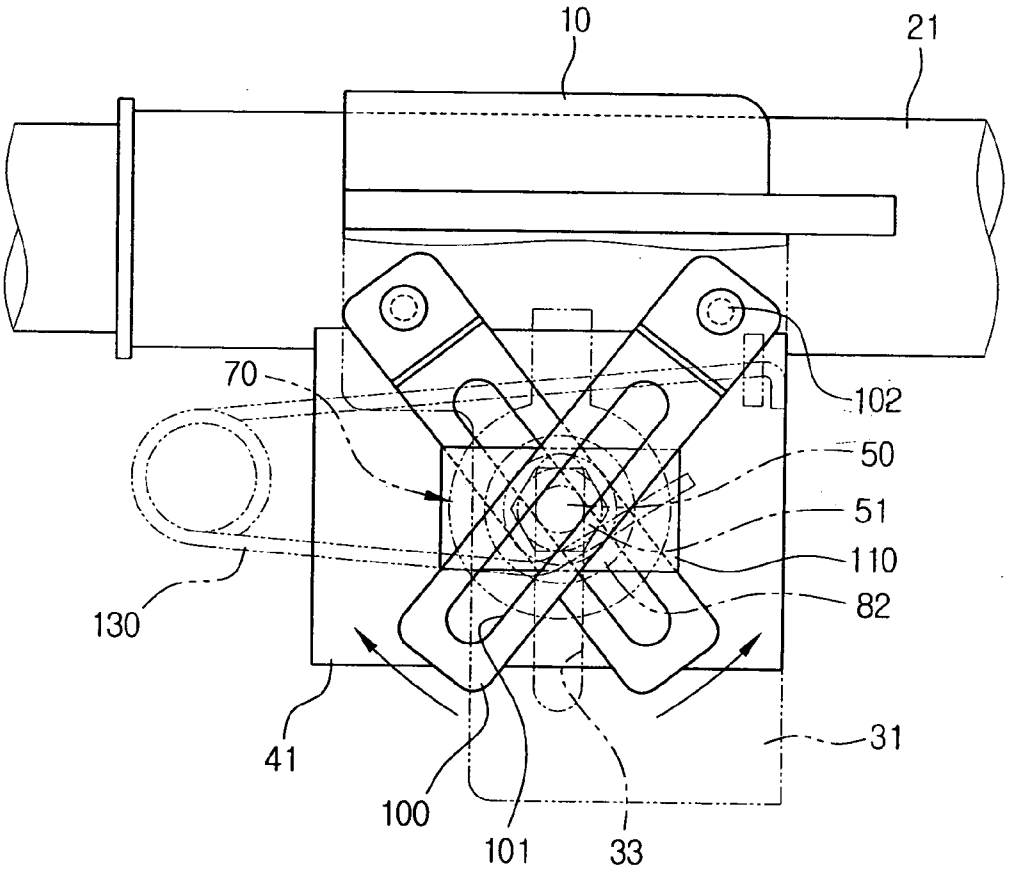
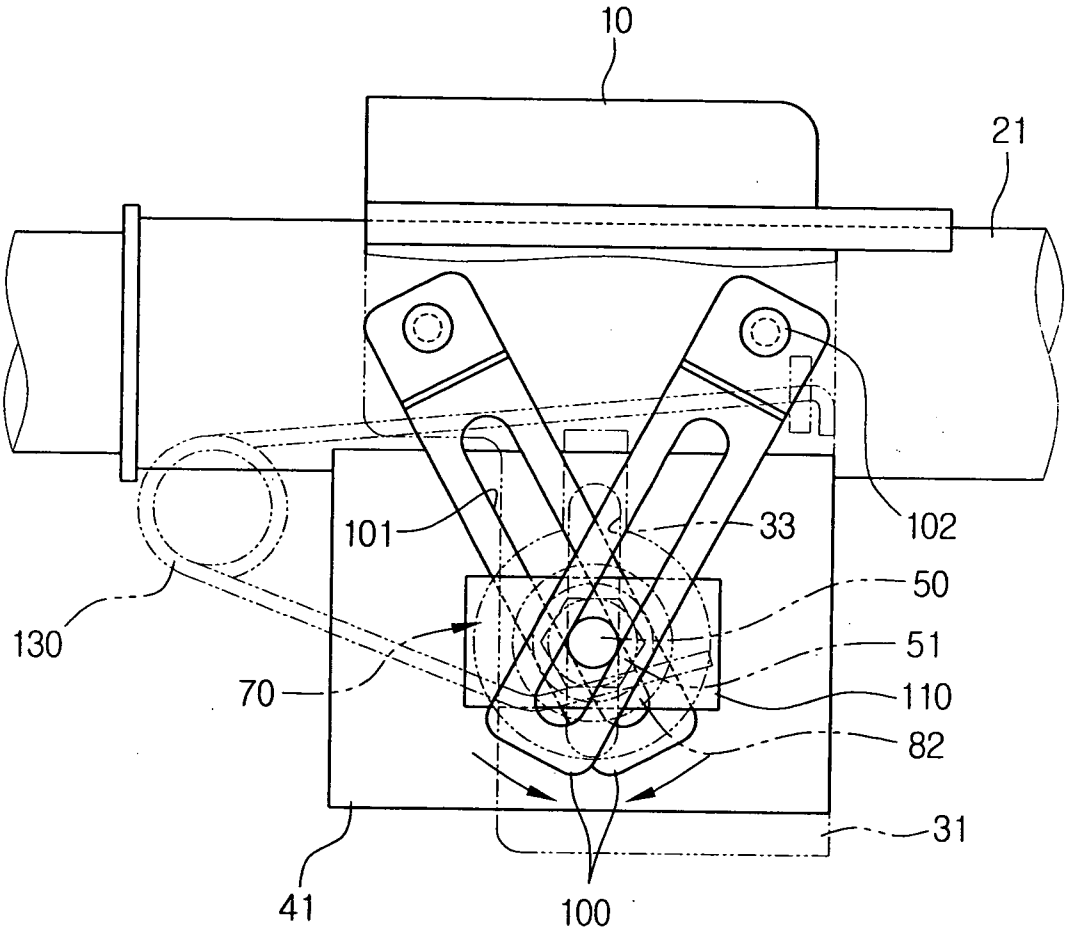


FIG. 7



TILT ADJUSTING UNIT FOR STEERING COLUMNS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Application No. 2003-528, filed Jan. 6, 2003 and Korean Patent Application No. 2003-529 filed on Jan. 6, 2003 and Korean Patent Application No. 2003-530 filed on Jan. 6, 2003, in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates, in general, to a tilt adjusting unit for steering columns and, more particularly, to a tilt adjusting unit for steering columns, which prevents a steering column from popping up due to an external impact.

[0004] 2. Description of the Related Art

[0005] Generally, a steering column for vehicles couples a steering wheel to axles of wheels, and functions to change a moving direction of a vehicle. As a user rotates the steering wheel in a direction, the steering column rotates in the same direction to control directions of the wheels, thus adjusting the moving direction of the vehicle.

[0006] Further, the steering column is constructed to be tiltable up and down, so that a position of the steering wheel is adjusted according to a user's size or preference, by adjusting an angle of the steering column. A hinge shaft is provided on a mid-part or a lower end of the steering column so that the steering column rotates around the hinge shaft. Further, a tilt adjusting unit is provided at a predetermined position around the steering column to guide a tilting motion of the steering column and lock the steering column at an adjusted angle.

[0007] As shown in **FIG. 1, a** conventional tilt adjusting unit for steering columns includes a mounting bracket **1**, first and second support brackets **3**, and a movable bracket **4**. The mounting bracket **1** is mounted to a predetermined portion of a vehicle body. The first and second support brackets **3** are mounted to the mounting bracket **1** to be placed on left and right sides of a steering column **2**. The movable bracket **4** is placed at a position between the first and second support brackets **3**, and is secured to the steering column **2**, through, for example, a welding process, to tilt along with the steering column **2**.

[0008] First and second support parts **5** are provided on left and right edges of the movable bracket **4** to be supported by inner surfaces of the first and second support brackets **3**, respectively. Each of the first and second support parts **5** has a through hole **5***a*, and a guide slot **3***a* is formed through each of the first and second support brackets **3** at a position corresponding to the through hole **5***a*. The first and second support brackets **3** and the movable bracket **4** are connected to each other, by an adjusting bolt **6** which passes through the through holes **5***a* of the first and second support parts **5** and the guide slots **3***a* of the first and second support brackets **3**.

[0009] Such a construction makes the adjusting bolt **6** move up and down along the guide slots **3***a* when the movable bracket **4** is angled vertically, thus adjusting the angle of the steering column **2** which is secured to the movable bracket **4**.

[0010] Further, the adjusting bolt **6** includes a head **6***a* and a shank **6***b*. The head **6***a* is provided at an end of the adjusting bolt **6** to be supported by an outer surface of one of the first and second support brackets **3**. The shank **6***b* extends from the head **6***a*, and passes through the first and second support brackets **3** and the first and second support parts **5** to be outwardly projected from a remaining one of the first and second brackets **3**. An external threaded part **6***c* is formed on an end of the shank **6***b* which passes through the first and second support brackets **3**. An adjusting nut **7** having an internal threaded part **7***a* engages with the external threaded part **6***c* of the adjusting bolt **6**. Further, an adjusting lever **8** is fastened to the adjusting nut **7** using a screw **9**.

[0011] Thus, when the angle of the steering column **2** is adjusted along the guide slots **3***a*, and the adjusting lever **8** rotates to tighten the adjusting nut **7**, the adjusting nut **7** presses the first and second support brackets **3**. At this time, friction between the first and second support brackets **3** and the movable bracket **4** increases, thus locking the steering column **2** at a desired angle.

[0012] Meanwhile, when a user desires to re-adjust the angle of the steering column **2** in such a state, the adjusting lever **8** rotates in a reverse direction to loosen the adjusting nut **7**. At this time, the friction between the first and second support brackets **3** and the movable bracket **4** reduces, thus allowing the angle of the steering column **2** to be adjusted again.

[0013] In the conventional tilt adjusting unit for steering columns, a locking force of the adjusting nut **7** is sufficient to lock the steering column **2**, in normal conditions. However, when a large external impact acts on the steering column **2**, the locking force of the adjusting nut **7** is insufficient to reliably lock the steering column **2** at a desired angle.

[0014] Thus, when the large external impact due to a collision between vehicles, acts on the steering column **2**, the steering column **2** may pop up from a locked position. However, the conventional tilt adjusting unit for steering columns has no unit which more reliably lock the steering column **2** to prevent the steering column **2** from popping up, except the adjusting nut **7**.

SUMMARY OF THE INVENTION

[0015] Accordingly, it is an aspect of the present invention to provide a tilt adjusting unit for steering columns, which prevents a steering column from popping up due to an external impact.

[0016] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0017] The above and/or other aspects are achieved by a tilt adjusting unit for steering columns, which includes a support bracket which is mounted to a predetermined portion of a vehicle body, a steering column which is mounted to a predetermined portion of the vehicle body to tilt relative to the vehicle body, a movable bracket which tilts along with

the steering column, a connection rod which connects the movable bracket to the support bracket, a guide slot which is formed on a predetermined portion of the support bracket along a tilting direction of the steering column, with the connection rod passing through the guide slot, a locking unit which is provided on a predetermined portion of the connection rod to lock or unlock the movable bracket to or from the support bracket, and a crossing plate which is mounted to a predetermined portion of the support bracket to rotate around an end of the crossing plate, and has a crossing slot to cross the guide slot, thus allowing the connection rod to pass through both the guide slot and the crossing slot.

[0018] The crossing plate may comprise a pair of crossing plates which cross each other.

[0019] The pair of crossing plates may rotate in opposing directions, when the movable bracket tilts.

[0020] The locking unit may include first and second stoppers which are provided on opposite ends of the connection rod, respectively, to prevent the movable bracket from being removed from the support bracket, a rotary unit which is rotatably provided on a predetermined portion of the connection rod between the first and second stoppers, a movable unit which is provided on a predetermined portion of the connection rod so that the movable unit and the rotary unit support each other, and moves along the connection rod as the rotary unit rotates, thus locking or unlocking the movable bracket to or from the support bracket, and a rotation restraining part which is provided on a predetermined portion of either the rotary unit or the movable unit to prevent the rotary unit from rotating when the movable bracket is locked to the support bracket.

[0021] The tilt adjusting unit may further include a first cam face which is provided on one of facing surfaces of the rotary unit and the movable unit which face each other, the first cam face having an inclined part inclined along a circumferential direction of the first cam face, and a second cam face which is provided on a remaining one of the facing surfaces of the rotary unit and the movable unit which face each other, the second cam face having a pressing part to press or release the inclined part according to a rotating direction of the rotary unit.

[0022] The rotation restraining part may be provided at an edge of the inclined part to stop the pressing part.

[0023] The inclined part may have a shape of a depression which is depressed on the first cam face, the pressing part may have a shape of a projection which is projected from the second cam face, and the rotation restraining part may be provided between the edge of the inclined part, which is adjacent to the second cam face, and the first cam face.

[0024] The inclined part may have a shape of a projection which is projected from the first cam face, the pressing part may be provided to receive the inclined part therein, and the rotation restraining part may extend from the edge of the inclined part, which is adjacent to the second cam face, into the pressing part.

[0025] The inclined part may comprise a plurality of inclined parts, and the pressing part may comprise a plurality of pressing parts corresponding to the plurality of inclined parts.

[0026] The movable unit and the connection rod may be provided to be prevented from rotating.

[0027] The movable unit may comprise a pair of movable units provided on opposite sides of the rotary unit, the pair of movable units may include an inner movable unit which is provided at a predetermined position inside the rotary unit, and an outer movable unit which is provided at a predetermined position outside the rotary unit.

[0028] The movable unit may be provided between the rotary unit and the support bracket.

[0029] A bearing may be provided on a side of the rotary unit which is opposite to the movable unit.

[0030] A lever may be provided on a predetermined portion of the rotary unit.

[0031] A friction plate may be provided between the movable bracket and the support bracket to increase a contact surface area between the movable bracket and the support bracket.

[0032] A first friction plate may be provided between the support bracket and one of the pair of crossing plates, and a second friction plate may be provided between the pair of crossing plates, the first and second friction plates increasing contact surface areas between the support bracket and the pair of crossing plates.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] These and other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the preferred embodiments, taken in conjunction with the accompanying drawings of which:

[0034] **FIG. 1** is a sectional view of a conventional tilt adjusting unit for steering columns;

[0035] **FIG. 2** is a sectional view of a tilt adjusting unit for steering columns, according to a first embodiment of the present invention;

[0036] **FIG. 3** is an exploded perspective view of the tilt adjusting unit for steering columns of **FIG. 2**;

[0037] **FIG. 4** is a sectional view of a tilt adjusting unit for steering columns, according to a second embodiment of the present invention;

[0038] **FIG. 5** is an exploded perspective view of the tilt adjusting unit for steering columns of **FIG. 4**; and

[0039] **FIGS. 6 and 7** are side views to show an operation of crossing plates included in the tilt adjusting unit for steering columns according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0040] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0041] A tilt adjusting unit for steering columns, according to a first embodiment of the present invention, adjusts an

angle of a steering column which tilts up and down, thus adjusting a height of a steering wheel which is provided at an upper end of the steering column. As shown in **FIGS. 2 and 3**, the tilt adjusting unit includes a mounting bracket **10**, a steering column **20**, and first and second support brackets **31** and **32**. The mounting bracket **10** is mounted to a predetermined portion of a vehicle body. The steering column **20** is provided to tilt up and down relative to the vehicle body. The first and second support brackets **31** and **32** extend from the mounting bracket **10** to be placed on left and right sides of the steering column **20**, respectively. In this case, the first support bracket **31** is provided to the left side of the steering column **20**, and the second support bracket **32** is provided to the right side of the steering column **20**.

[**0042**] Between the first and second support brackets **31** and **32** is provided a movable bracket **40** which is secured to the steering column **20** to tilt along with the steering column **20**. A cover member **21** covers the steering column **20**, and the movable bracket **40** is secured to the cover member **21** of the steering column **20** through, for example, a welding process.

[**0043**] First and second support parts **41** extend from left and right edges of the movable bracket **40** to be supported by inner surfaces of the first and second support brackets **31** and **32**, respectively. Each of the first and second support parts **41** has a through hole **43** at a predetermined portion thereof, and a guide slot **33** is formed along a tilting direction of the steering column **20** through each of the first and second support brackets **31** and **32** at a position corresponding to the through hole **43**. The first and second support brackets **31** and **32** and the movable bracket **40** are connected to each other by a connection rod **50** which passes through the through holes **43** of the first and second support parts **41** and the guide slots **33** of the first and second support brackets **31** and **32**.

[**0044**] Thus, when the movable bracket **40** tilts up and down, the connection rod **50** moves up and down along the guide slots **33** while changing the angle of the steering column **20** which is secured to the movable bracket **40**.

[**0045**] Further, a locking unit **60** is provided on a predetermined portion of the connection rod **50**. The locking unit **60** presses the first support bracket **31** to the movable bracket **40** to increase friction between the first and second brackets **31** and **32** and the movable bracket **40**. Thus, the movable bracket **40** is locked to the first and second support brackets **31** and **32**. In this way, the steering column **20** is locked at a desired angle.

[**0046**] The locking unit **60** includes first and second stoppers **51** and **52**, a rotary unit **70**, and inner and outer movable units **81** and **82**. The first and second stoppers **51** and **52** are respectively provided on opposite ends of the connection rod **50**, to prevent the movable bracket **40** from being removed from the first and second support brackets **31** and **32**. The rotary unit **70** is provided on a predetermined portion of the connection rod **50** between the first stopper **51** and the first support bracket **31**. In this case, the rotary unit **70** is rotatably provided. Further, the inner and outer movable units **81** and **82** are provided so that the inner and outer movable units **81** and **82** and the rotary unit **70** support each other, and the inner and outer movable units **81** and **82** move along the connection rod **50** as the rotary unit **70** rotates, thus locking or unlocking the movable bracket **40** to or from the first and second support brackets **31** and **32**.

[**0047**] The first stopper **51** is fastened to a first end of the connection rod **50** to be placed outside the first support bracket **31**, in a screw-type fastening method. The second stopper **52** is integrally provided on a second end of the connection rod **50** to be placed outside the second support bracket **32**. To fasten the first stopper **51** to the first end of the connection rod **50** in the screw-type fastening method, the first stopper **51** has an internal threaded part **51***a*, and the connection rod **50** has an external threaded part **50***a* on the first end thereof.

[**0048**] The rotary unit **70** includes a body **71** and a lever **72**. The body **71** has at a central portion thereof a locking hole **71***a* so that the connection rod **50** passes through the locking hole **71***a*. The lever **72** extends from the body **71** to a predetermined height. The inner and outer movable units **81** and **82** are provided on right and left sides of the rotary unit **70**, respectively. In this case, the inner movable unit **81** is provided at a predetermined position inside the rotary unit **70**, while the outer movable unit **82** is provided at a predetermined position outside the rotary unit **70**. Further, the inner and outer movable units **81** and **82** are provided to be symmetrical with each other relative to the rotary unit **70**. The inner and outer movable units **81** and **82** respectively have locking holes **83** so that the connection rod **50** passes through the locking holes **83**.

[**0049**] A first cam face **85** is provided on each of facing surfaces of the inner and outer movable units **81** and **82** which face the rotary unit **70**. The first cam face **85** has an inclined part **84** which is inclined along a circumferential direction of the first cam face **85**. Further, a second cam face **74** is provided on each of opposite surfaces of the rotary unit **70** which face the inner and outer movable units **81** and **82**. The second cam face **74** has a pressing part **73** to press or release the inclined part **84** of the first cam face **85** according to a rotating direction of the rotary unit **70**.

[**0050**] When the rotary unit **70** rotates in a direction to cause an operation of the pressing parts **73** of the second cam faces **74** of the rotary unit **70**, in conjunction with the inclined parts **84** of the first cam faces **85** of the inner and outer movable units **81** and **82**, the inner and outer movable units **81** and **82** move away from the rotary unit **70** in opposing directions. Because movements of the rotary unit **70** and the inner and outer movable units **81** and **82** along the connection rod **50** are limited by the first and second stoppers **51** and **52**, the rotary unit **70** and the inner and outer movable units **81** and **82** move toward the first support bracket **31** by moving distances of the first and second movable units **81** and **82**, thus pressing the first support bracket **31**. Thus, the movable bracket **40** is in close contact with the first and second support brackets **31** and **32** to be locked to the first and second support brackets **31** and **32**. On the other hand, when the rotary unit **70** rotates in a reverse direction, the inclined parts **84** are released from the pressing parts **73**, and simultaneously, the first support bracket **31** is released from the locking unit **60**. Thereby, the movable bracket **40** is unlocked from the first and second support brackets **31** and **32**.

[**0051**] Although the first cam faces **85** may be provided on the opposite surfaces of the rotary unit **70** and the second cam faces **74** may be provided on the facing surfaces of the inner and outer movable units **81** and **82** which face the rotary unit **70**, the inner and outer movable units **81** and **82**

may move away from the rotary unit **70** by a rotation of the rotary unit **70**. Thus, the first cam faces **85** may be provided on the opposite surfaces of the rotary unit **70** and the second cam faces **74** may be provided on the facing surfaces of the inner and outer movable units **81** and **82** which face the rotary unit **70**. Preferably, the inclined part **84** may comprise a plurality of inclined parts and the pressing part **73** may comprise a plurality of pressing parts corresponding to the plurality of inclined parts, so as to allow the inner and outer movable units **81** and **82** to more stably and smoothly move.

[**0052**] Further, when the locking unit **60** is operated, and a torque generated by the rotation of the rotary unit **70** is transmitted to the inner and outer movable units **81** and **82** or to the connection rod **50**, the inner and outer movable units **81** and **82** and the connection rod **50** rotate and thereby the inner and outer movable units **81** and **82** may not move away from the rotary unit **70** in opposing directions. Thus, in order to make the inner and outer movable units **81** and **82** move away from the rotary unit **70**, the connection rod **50** and the inner and outer movable units **81** and **82** are provided so that the connection rod **50** and the inner and outer movable units **81** and **82** are prevented from rotating.

[**0053**] To prevent the connection rod **50** and the inner and outer movable units **81** and **82** from rotating, a first rotation preventing projection **81***a* is provided on a surface of the inner movable unit **81** which is opposite to the first cam face **85**, and the first rotation preventing projection **81***a* is supported by the first support bracket **31**. A second rotation preventing projection **52***a* is provided on a predetermined portion of the second stopper **52** to be supported by the second support bracket **32**. Further, a third rotation preventing projection **82***a* is provided on a surface of the outer movable unit **82** which is opposite to the first cam face **85**, and the third rotation preventing projection **82***a* is supported by the first stopper **51**. The first, second, and third rotation preventing projections **81***a*, **52***a*, and **82***a* prevent the inner and outer movable units **81** and **82** and the connection rod **50** from rotating. Thus, when the rotary unit **70** rotates, the inner and outer movable units **81** and **82** rectilinearly reciprocate along the connection rod **50**, but do not rotate.

[**0054**] Preferably, the first and second rotation preventing projections **81***a* and **52***a* are fitted into the guide slots **33** of the first and second support brackets **31** and **32**, respectively, so that the first and second rotation preventing projections **81***a* and **52***a* are supported by the first and second support brackets **31** and **32**, respectively, without any mounting member. Further, the first stopper **51** has a seat groove **51***b* so that the third rotation preventing projection **82***a* is seated in the first stopper **51**.

[**0055**] A rotation restraining part **90** is provided on a predetermined portion of one of the rotary unit **70** and the inner and outer movable units **81** and **82** to prevent the rotary unit **70** from rotating when the movable bracket **40** is locked to the first and second support brackets **31** and **32**.

[**0056**] The rotary unit **70** is restrained not to rotate by the rotation restraining part **90** when the movable bracket **40** is locked to the first and second support brackets **31** and **32**, thus allowing a user to easily confirm whether the steering column **20** is locked at a desired angle or not.

[**0057**] The rotation restraining part **90** is provided at an edge of the inclined part **84** which is provided on the first cam face **85** to prevent the rotary unit **70** from rotating when the inner and outer movable units **81** and **82** move away from the rotary unit **70** to a maximum, thus allowing the user to easily confirm whether the steering column **20** is locked at the desired angle or not.

[**0058**] The inclined part **84** has a shape of a depression which is depressed on the first cam face **85**, and the pressing part **73** has a shape of a projection which is projected from the cam face **74**. The rotation restraining part **90** is provided between the edge of the inclined part **84**, which is adjacent to the second cam face **74**, and the first cam face **85**.

[**0059**] To an inner surface of each of the first and second support brackets **31** and **32** are mounted crossing plates **100**. Each of the crossing plates **100** is mounted to rotate around an end thereof, and has a crossing slot **101** to cross the guide slot **33** of each of the first and second support brackets **31** and **32**, thus allowing the connection rod **50** to pass through the guide slot **33** and the crossing slots **101**.

[**0060**] The crossing plates **100** allow the movable bracket **40** to be more firmly locked to the first and second support brackets **31** and **32**, thus efficiently preventing the steering column **20** from popping up. The operation of the crossing plates **100** will be described in the following in detail.

[**0061**] When a large external impact due to the collision between vehicles acts on the steering column **20**, a locking force of the locking unit **60** may be insufficient to reliably lock the movable bracket **40** to the first and second support brackets **31** and **32**. Thereby, the steering column **20** may pop up. However, the tilt adjusting unit for steering columns according to the present invention is provided with the crossing plates **100**, thus more efficiently preventing the steering column **20** from popping up.

[**0062**] In a detailed description, the crossing slot **101** is formed through each of the crossing plates **100** to cross the guide slot **33** of each of the first and second support brackets **31** and **32**. Further, each of the crossing plates **100** has at an end thereof a rivet hole **103**, and each of the first and second support brackets **31** and **32** has a rivet hole **34** at a position corresponding to the rivet hole **103** so that a rivet member **102** passes through the rivet holes **103** and **34**. As such, since the rivet member **102** is fastened to each of the first and second support brackets **31** and **32** through the rivet holes **103** and **34**, the crossing plates **100** are mounted to the first and second support brackets **31** and **32** to rotate around the rivet holes **103** and **34**. In this case, the rivet members **102** having first ends are fitted into the rivet holes **103** and **34**, and protruding ends thereof are pressed to form second ends.

[**0063**] Further, the connection rod **50** passes through the crossing slots **101** of the crossing plates **100**. Thus, when the large external impact due to the collision between vehicles acts on the steering column **20** and a force of impact is larger than the locking force of the locking unit **50** which locks the movable bracket **40** to the first and second support brackets **31** and **32**, the movable bracket **40** is apt to be released from the first and second support brackets **31** and **32**. However, at this time, the crossing plates **100** rotate around the rivet holes **103** and **34**, and rotating forces of the crossing plates **100** are applied to the connection rod **50**. The rotating forces of the crossing plates **100** serve as a resistance against a movement of the connection rod **50** along the guide slots **33**. Therefore, such a construction prevents an undesired move-

ment of the movable bracket **40**, and thereby preventing the steering column **20** from popping up.

[**0064**] In order to more efficiently prevent the steering column **20** from popping up using the crossing plates **100**, a pair of crossing plates **100** which are inside and outside crossing plates **100** are provided to cross each other on a predetermined portion of each of the first and second support brackets **31** and **32**. In the above state, a pair of rivet holes **34** are formed on each of the first and second support brackets **31** and **32** at positions on left and right sides of the guide slot **33**. The pair of crossing plates **100** are rotatably mounted to the pair of rivet holes **34** of each of the first and second support brackets **31** and **32**, respectively, by two rivet members **102** which are fitted into the aligned rivet holes **103** and **34**, so that the pair of crossing plates **100** cross each other.

[**0065**] Each pair of crossing plates **100** which are placed to cross each other, rotate in opposing directions, when the movable bracket **40** moves. When the movable bracket **40** is locked to the first and second support brackets **31** and **32**, the crossing plates **100** which cross each other more efficiently prevent the connection rod **50** from moving along the guide slots **33**.

[**0066**] Further, when the first support bracket **31** is pressed by the locking unit **60** to lock the steering column **20** at the desired angle, the crossing plates **100** increase contact surface areas between the first support part **41** of the movable bracket **40** and the first support bracket **31**, and between the second support part **41** of the movable bracket **40** and the second support bracket **32**, thus allowing the movable bracket **40** to be more reliably locked to the first and second support brackets **31** and **32**.

[**0067**] Further, on each of the first and second support brackets **31** and **32**, a pair of friction plates **110** are respectively provided between the outside crossing plate **100** and the first or second support bracket **31** or **32**, and between the inside and outside crossing plates **100**. Each of the friction plates **110** has a through hole **111** at a central portion thereof so that the connection rod **50** passes through the through hole **111**. The friction plates **110** increase contact surface areas between the first and second support brackets **31** and **32** and the movable bracket **40**, in cooperation with the crossing plates **100**, thus allowing the movable bracket **40** to be more reliably locked to the first and second support brackets **31** and **32**, and thereby more efficiently preventing the steering column **20** from popping up.

[**0068**] According to the first embodiment of the present invention, the tilt adjusting unit for steering columns is provided with two movable units. But, the steering column **20** may be locked using a locking unit **60'** which has one movable unit. A tilt adjusting unit having one movable unit according to a second embodiment will be described in the following.

[**0069**] Since the general construction of the tilt adjusting unit according to the second embodiment remains the same as the tilt adjusting unit according to the first embodiment, except for a construction of the locking unit **60'**, those elements common to the first and second embodiments will not be described herein in detail.

[**0070**] As shown in **FIGS. 4 and 5**, in the tilt adjusting unit for steering columns according to the second embodiment, the locking unit **60'** includes a rotary unit **70'** and one movable unit **81'** at predetermined positions between a first stopper **51'** and the first support bracket **31**. The movable unit **81'** is provided between the rotary unit **70'** and the first support bracket **31**. A bearing **120** is provided between the first stopper **51'** and the rotary unit **70'** to ensure a smooth rotation of the rotary unit **70'**.

[**0071**] The rotary unit **70'** includes a body **71'** which has at a central portion thereof a locking hole **71***a'* so that the connection rod **50** passes through the locking hole **71***a'*. A lever **72'** extends from the body **71'** to a predetermined height. Further, the movable unit **81'** has a locking hole **83'** at a central portion thereof so that the connection rod **50** passes through the locking hole **83'**. First and second cam faces **85'** and **74'** are provided on facing surfaces of the movable unit **81'** and the rotary unit **70'**, respectively. In this case, the first cam face **85'** has an inclined part **84'**, and the second cam face **74'** has a pressing part **73'**. Alternatively, the first and second cam faces **85'** and **74'** may be respectively provided on the facing surfaces of the rotary unit **70'** and the movable unit **81'**. Further, the inclined part **84'** comprises a plurality of inclined parts, and the pressing part **73'** comprises a plurality of pressing parts corresponding to the plurality of inclined parts, thus allowing the movable unit **81'** to stably move.

[**0072**] Similarly to the first embodiment, when the rotary unit **70'** rotates in a direction, the inclined parts **84'** are pressed by the pressing parts **73'** and the movable unit **81'** moves away from the rotary unit **70'**. At this time, the rotary unit **70'** and the movable unit **81'** move toward the first support bracket **31** by the first stopper **51'** while pressing the first support bracket **31**, thus locking the movable bracket **40** to the first and second support brackets **31** and **32**. On the other hand, when the rotary unit **70'** rotates in a reverse direction in such a state, the inclined parts **84'** are released from the pressing parts **73'** and the movable unit **81'** returns to an original position thereof. Thereby, the movable bracket **40** is unlocked from the first and second support brackets **31** and **32**.

[**0073**] Further, a rotation restraining part **90'** is provided at an edge of each of the inclined parts **84'** which are provided on the first cam face **85'**, thus preventing the rotary unit **70'** from rotating when the steering column **20** is locked. According to the second embodiment of the present invention, each of the inclined parts **84'** has a shape of a projection which is projected from the first cam face **85'**, and each of the pressing parts **73'** has a shape of a hole which is formed through the rotary unit **70'** to receive the corresponding inclined part **84'**, thus pressing the inclined part **84'** when the rotary unit **70'** rotates. The rotation restraining part **90'** extends from the edge of the inclined part **84'**, which is adjacent to the second cam face **74'**, into the pressing part **73'**.

[**0074**] Thus, before the steering column **20** is locked, each of the inclined parts **84'** is placed in the corresponding pressing part **73'**. As the rotary unit **70'** rotates in a direction, each of the inclined parts **84'** moves to an outside of the corresponding pressing part **73'**, so that the movable unit **81'** moves away from the rotary unit **70'**. When the rotary unit **70'** continuously rotates in such a state, an edge of each of the pressing parts **73'** which has the shape of the hole is stopped by each of the rotation restraining parts **90'** which

extends into each of the pressing parts **73'**. In this case, the movable unit **81'** moves away from the rotary unit **70'** to a maximum and thereby the movable bracket **40** is locked to the first and second support brackets **31** and **32**. In such a state, because the edge of each of the pressing parts **73'** is stopped by each of the rotation restraining part **90'**, the rotary unit **70'** does not rotate any more, thus allowing the user to easily confirm whether the steering column **20** is locked at the desired angle or not.

[**0075**] In the tilt adjusting unit according to the second embodiment, the movable unit **81'** and the connection rod **50** are prevented from rotating by a torque which is generated by a rotation of the rotary unit **70'** when the locking unit **60'** is operated, similarly to the tilt adjusting unit of the first embodiment. To prevent the movable unit **81'** and the connection rod **50** from rotating, a first rotation preventing projection **81***a'* is provided on a surface of the movable unit **81'** which is opposite to the first cam face **85'**, and the first rotation preventing projection **81***a'* is supported by the first support bracket **31**. Further, a second rotation preventing projection **52***a* is provided on a predetermined portion of the second stopper **52** to be supported by the second support bracket **32**. The first and second rotation preventing projections **81***a'* and **52***a* prevent the movable unit **81'** and the connection rod **50** from rotating. Thus, the movable unit **81'** only rectilinearly reciprocates along the connection rod **50**.

[**0076**] The first and second rotation preventing projections **81***a'* and **52***a* are fitted into the guide slots **33** of the first and second support brackets **31** and **32**, respectively, so that the first and second rotation preventing projections **81***a'* and **52***a* are supported by the first and second support brackets **31** and **32**, respectively, without using any mounting member.

[**0077**] In the locking unit **60**, **60'** according to the first and second embodiments, the rotary unit **70**, **70'** and the movable units **81** and **82**, **81'** are provided between the first stopper **51**, **51'** and the first support bracket **31**. However, when the movable unit **81** and **82**, **81'** and the connection rod **50** are provided to be prevented from rotating, the rotary unit **70**, **70'** and the movable unit **81** and **82**, **81'** may be provided between the second stopper **52** and the second support bracket **32**, or between the first and second support brackets **31** and **32** and the movable bracket **40**, or between the first and second support parts **41** of the movable bracket **40**. Thus, as the rotary unit **70**, **70'** rotates, the movable unit **81** and **82**, **81'** moves away from the rotary unit **70**, **70'** and thereby the movable bracket **40** is supported by the first and second support brackets **31** and **32**.

[**0078**] The operation and operational effect of the tilt adjusting unit for steering columns according to the present invention will be described in the following in detail, with reference to **FIGS. 6 and 7**. Since the crossing plates **100** and the friction plates **110** of the first embodiment are operated in a same manner as the crossing plates **100** and the friction plates **110** of the second embodiment, and the general operation of the locking unit **60'** of the second embodiment is very similar to the general operation of the locking unit **60** of the first embodiment, the operation and operational effect of the tilt adjusting unit for steering columns according to the present invention will be described in the following with reference to only the first embodiment.

[**0079**] First, after the angle of the steering column **20** is appropriately adjusted, the user rotates the rotary unit **70** in a direction using the lever **72**. At this time, each of the pressing parts **73** provided on the second cam face **74** moves along each of the inclined parts **84** of the first cam face **85** until being stopped by the rotation restraining part **90** which is provided at the edge of each of the inclined parts **84**. Further, the inner and outer movable units **81** and **82** move away from the rotary unit **70** in opposing directions to the maximum. In this case, because the first stopper **51** is fixed not to move, the rotary unit **70** and the inner and outer movable units **81** and **82** which are provided between the first support bracket **31** and the first stopper **51**, move along the connection rod **50** toward the first support bracket **31** by a distance between the inner and outer movable units **81** and **82** which move away from the rotary unit **70** in opposing directions, and thereby press the first support bracket **31**. Therefore, the first and second support brackets **31** and **32** come into close contact with the first and second support parts **41** of the movable bracket **40**, respectively. The movable bracket **40** is locked to the first and second support brackets **31** and **32**, and the steering column **40** which is secured to the movable bracket **40** is also locked. At this time, because each of the pressing parts **73** is stopped by the rotation restraining part **90** which is provided at the edge of each of the inclined parts **84**, the rotary unit **70** does not any rotate more although the lever **72** is operated, thus allowing the user to reliably confirm whether the steering column **20** is locked or not.

[**0080**] When a large impact exceeding the locking force of the locking unit **60** due to the collision between vehicles, acts on the steering column **20**, the steering column **20** is apt to be released from a locked position. However, at this time, as shown in **FIG. 6**, the pair of crossing plates **100** which are mounted to each of the first and second support brackets **31** and **32** rotate in opposing directions, thus biasing the connection rod **50** in rotating directions of the crossing plates **100** to prevent the connection rod **50** from moving along the guide slot **33**. Thereby, a force to support the connection rod **50** to the first and second support brackets **31** and **32** is increased by the crossing plates **100**, and the movable bracket **40** is continuously locked to the first and second support brackets **31** and **32**. Further, the friction plates **110** increase the contact surface areas between the first and second support brackets **31** and **32** and the movable bracket **40**, together with the crossing plates **100**, thus allowing the movable bracket **40** to be more reliably locked. In the present invention, the locking unit **60**, the crossing plates **100**, and the friction plates **110** prevent the steering column **20** from popping up, so that the steering column **20** is held at the locked position. The reference numeral **130** denotes an elastic member to elastically support the connection rod **50** to each of the first and second support brackets **31** and **32**.

[**0081**] Meanwhile, when the user desires to re-adjust the angle of the steering column **20** which is locked as described above, the user rotates the rotary unit **70** using the lever **72** in a direction which is opposite to a rotating direction of the rotary unit **70** to lock the steering column **20**. At this time, each of the pressing parts **73** of the second cam face **74** moves along each of the inclined parts **84** of the first cam face **85** in a direction away from the rotation restraining part **90**. In this case, the inner and outer movable units **81** and **82** return to original positions thereof, while the movable bracket **40** is unlocked from the first and second support brackets **31** and **32**, so that the movable bracket **40** moves along the guide slots **33**. In this way, the angle of the steering

column **20** is adjusted again. When the angle of the steering column **20** is adjusted, the crossing plates **100** rotate in opposing directions together with a movement of the connection rod **50** along the guide slots **33**, as shown in **FIG. 7**.

[**0082**] As is apparent from the above description, the present invention provides a tilt adjusting unit for steering columns, which is provided with crossing plates to more reliably lock a steering column in cooperation of a locking unit, thus preventing the steering column from popping up. Further, according to the present invention, the tilt adjusting unit is provided with friction plates to increase contact surface areas between a movable bracket and support brackets, thus more efficiently preventing the steering column from popping up. In the tilt adjusting unit of the present invention, the locking unit is provided with a rotation restraining part, thus allowing a user to easily confirm whether the steering column is locked or not.

[**0083**] Although a few preferred embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A tilt adjusting unit for steering columns, comprising:

a support bracket mounted to a predetermined portion of a vehicle body;

a steering column mounted to a predetermined portion of the vehicle body to tilt relative to the vehicle body;

a movable bracket to tilt along with the steering column;

a connection rod to connect the movable bracket to the support bracket;

a guide slot formed on a predetermined portion of the support bracket along a tilting direction of the steering column, with the connection rod passing through the guide slot;

a locking unit provided on a predetermined portion of the connection rod to lock or unlock the movable bracket to or from the support bracket; and

a crossing plate mounted to a predetermined portion of the support bracket to rotate around an end of the crossing plate, the crossing plate having a crossing slot to cross the guide slot, thus allowing the connection rod to pass through both the guide slot and the crossing slot.

2. The tilt adjusting unit according to claim 1, wherein the crossing plate comprises a pair of crossing plates which cross each other.

3. The tilt adjusting unit according to claim 2, wherein the pair of crossing plates rotate in opposing directions, when the movable bracket tilts.

4. The tilt adjusting unit according to claim 1, wherein the locking unit comprises:

first and second stoppers provided on opposite ends of the connection rod, respectively, to prevent the movable bracket from being removed from the support bracket;

a rotary unit rotatably provided on a predetermined portion of the connection rod between the first and second stoppers;

a movable unit provided on a predetermined portion of the connection rod so that the movable unit and the rotary unit support each other, the movable unit moving along the connection rod as the rotary unit rotates, thus locking or unlocking the movable bracket to or from the support bracket; and

a rotation restraining part provided on a predetermined portion of either the rotary unit or the movable unit to prevent the rotary unit from rotating when the movable bracket is locked to the support bracket.

5. The tilt adjusting unit according to claim 4, further comprising:

a first cam face provided on one of facing surfaces of the rotary unit and the movable unit which face each other, the first cam face having an inclined part which is inclined along a circumferential direction of the first cam face; and

a second cam face provided on a remaining one of the facing surfaces of the rotary unit and the movable unit which face each other, the second cam face having a pressing part to press or release the inclined part according to a rotating direction of the rotary unit.

6. The tilt adjusting unit according to claim 5, wherein the rotation restraining part is provided at an edge of the inclined part to stop the pressing part.

7. The tilt adjusting unit according to claim 6, wherein the inclined part has a shape of a depression which is depressed on the first cam face, the pressing part has a shape of a projection which is projected from the second cam face, and the rotation restraining part is provided between the edge of the inclined part, which is adjacent to the second cam face, and the first cam face.

8. The tilt adjusting unit according to claim 6, wherein the inclined part has a shape of a projection which is projected from the first cam face, the pressing part is provided to receive the inclined part therein, and the rotation restraining part extends from the edge of the inclined part, which is adjacent to the second cam face, into the pressing part.

9. The tilt adjusting unit according to claim 5, wherein the inclined part comprises a plurality of inclined parts, and the pressing part comprises a plurality of pressing parts corresponding to the plurality of inclined parts.

10. The tilt adjusting unit according to claim 5, wherein the movable unit and the connection rod are provided to be prevented from rotating.

11. The tilt adjusting unit according to claim 5, wherein the movable unit comprises a pair of movable units provided on opposite sides of the rotary unit, the pair of movable units comprising:

an inner movable unit provided at a predetermined position inside the rotary unit; and

an outer movable unit provided at a predetermined position outside the rotary unit.

12. The tilt adjusting unit according to claim 5, wherein the movable unit is provided between the rotary unit and the support bracket.

13. The tilt adjusting unit according to claim 12, further comprising a bearing provided on a side of the rotary unit which is opposite to the movable unit.

14. The tilt adjusting unit according to claim 4, further comprising a lever provided on a predetermined portion of the rotary unit.

15. The tilt adjusting unit according to claim 1, further comprising a friction plate provided between the movable

bracket and the support bracket to increase a contact surface area between the movable bracket and the support bracket.

16. The tilt adjusting unit according to claim 3, further comprising:

a first friction plate provided between the support bracket and one of the pair of crossing plates; and

a second friction plate provided between the pair of crossing plates, the first and second friction plates increasing contact surface areas between the support bracket and the pair of crossing plates.

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