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(12) **United States Patent**
Jackson

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(54) **PITCH CHANGING MECHANISMS FOR STRINGED MUSICAL INSTRUMENTS**

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(72) Inventor: **David Jackson**, Dahlonega, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/390,950**

(22) Filed: **Dec. 27, 2016**

(51) **Int. Cl.**
G10D 3/06 (2006.01)
G10D 1/08 (2006.01)
G10D 3/14 (2006.01)

(52) **U.S. Cl.**
CPC ***G10D 3/06*** (2013.01); ***G10D 1/08*** (2013.01); ***G10D 3/14*** (2013.01)

(58) **Field of Classification Search**
CPC G10D 3/14; G10D 1/08
See application file for complete search history.

(56) **References Cited**

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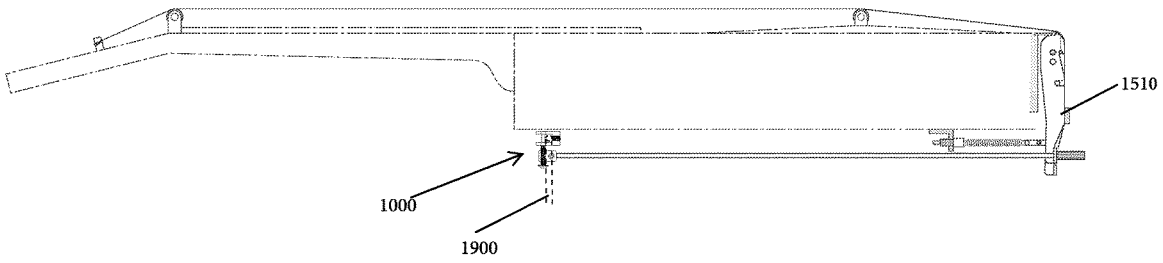
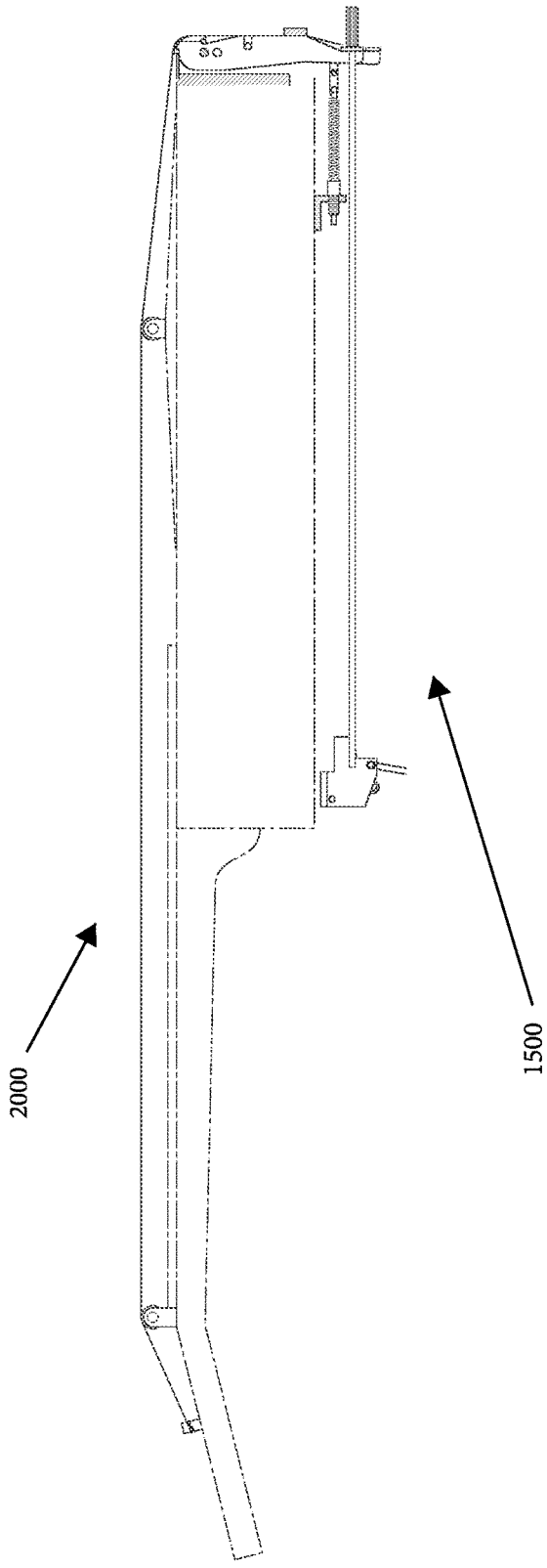
(57) **ABSTRACT**

Disclosed are pitch changing mechanisms, including fine-tuning and micro adjustment mechanisms. One mechanism is an adjustable tuning rod holder for a stringed instrument that is configured for both (A) fine tuning of the height of a pull-rod relative to a rod puller and pitch changer and (B) alignment the rod puller **1000** with the string **2500** on the instrument **2000**. Other embodiments include roller nut and roller bridge housings. Yet still, disclosed are embodiments of pivot plates for fine or micro adjustments of the angle of a neck of a stringed instrument relative to the instruments body.

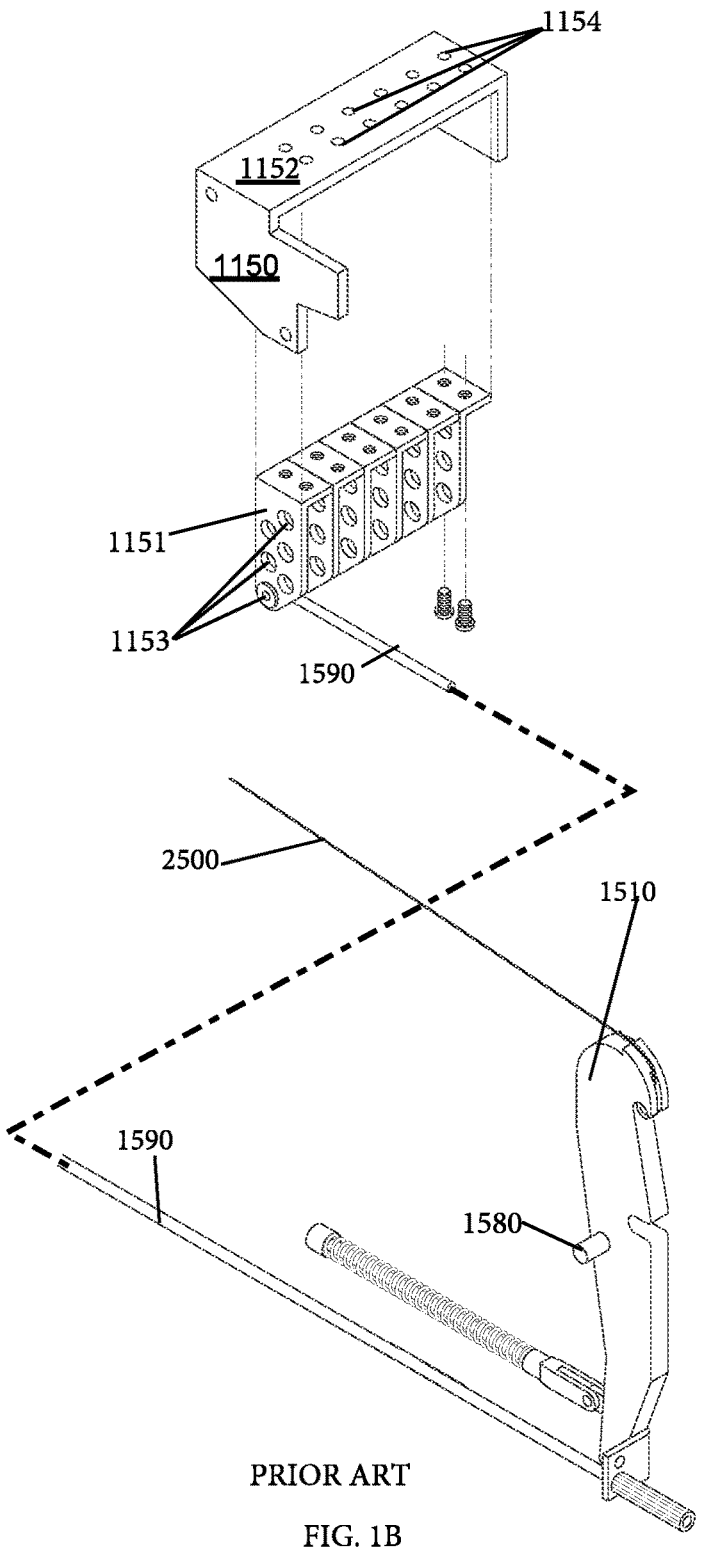
5 Claims, 15 Drawing Sheets





PRIOR ART

FIG. 1A



PRIOR ART

FIG. 1B

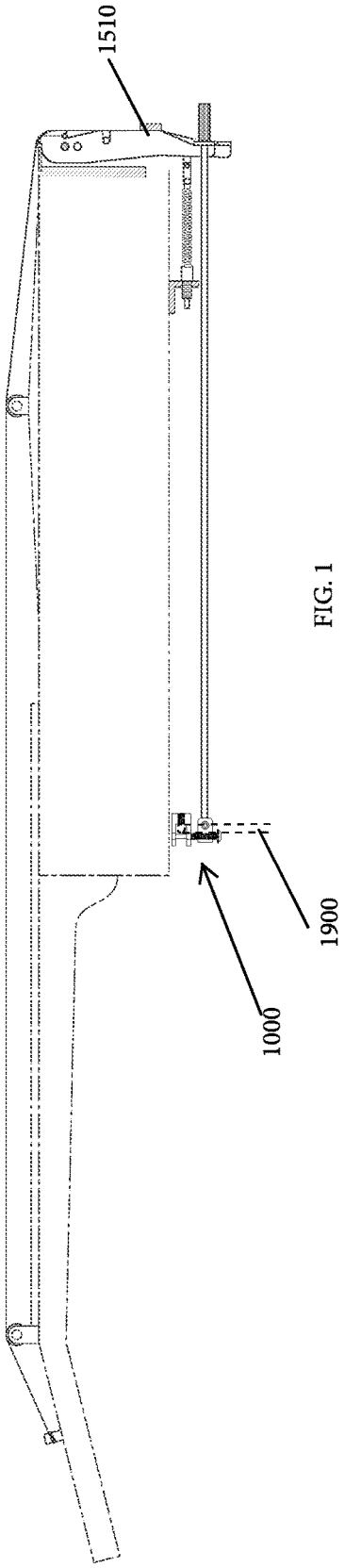


FIG. 1

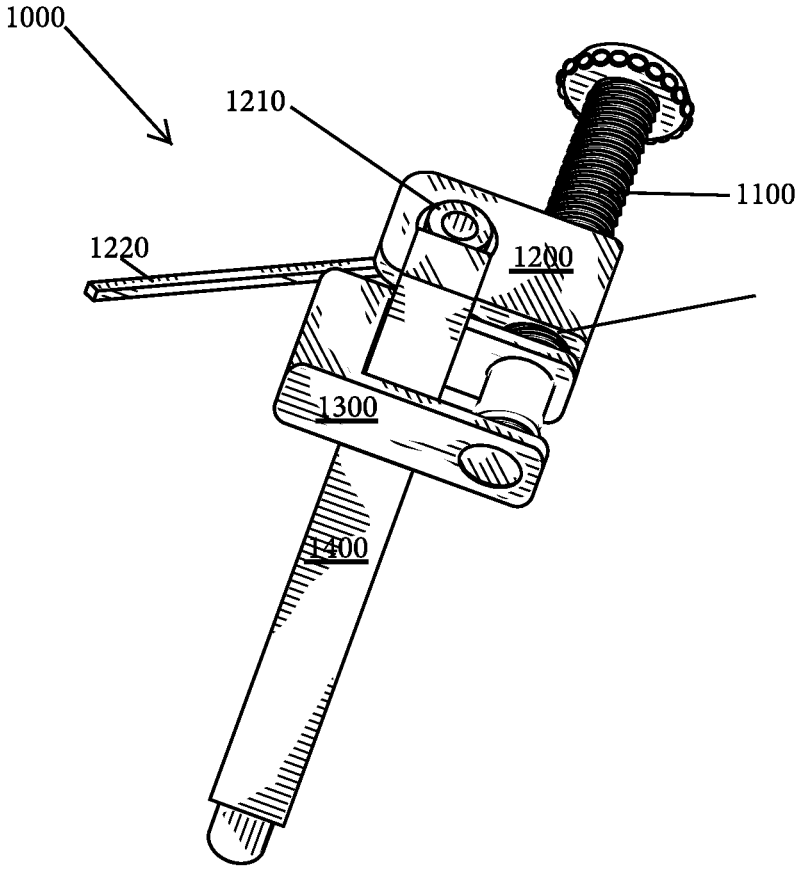


FIG. 2

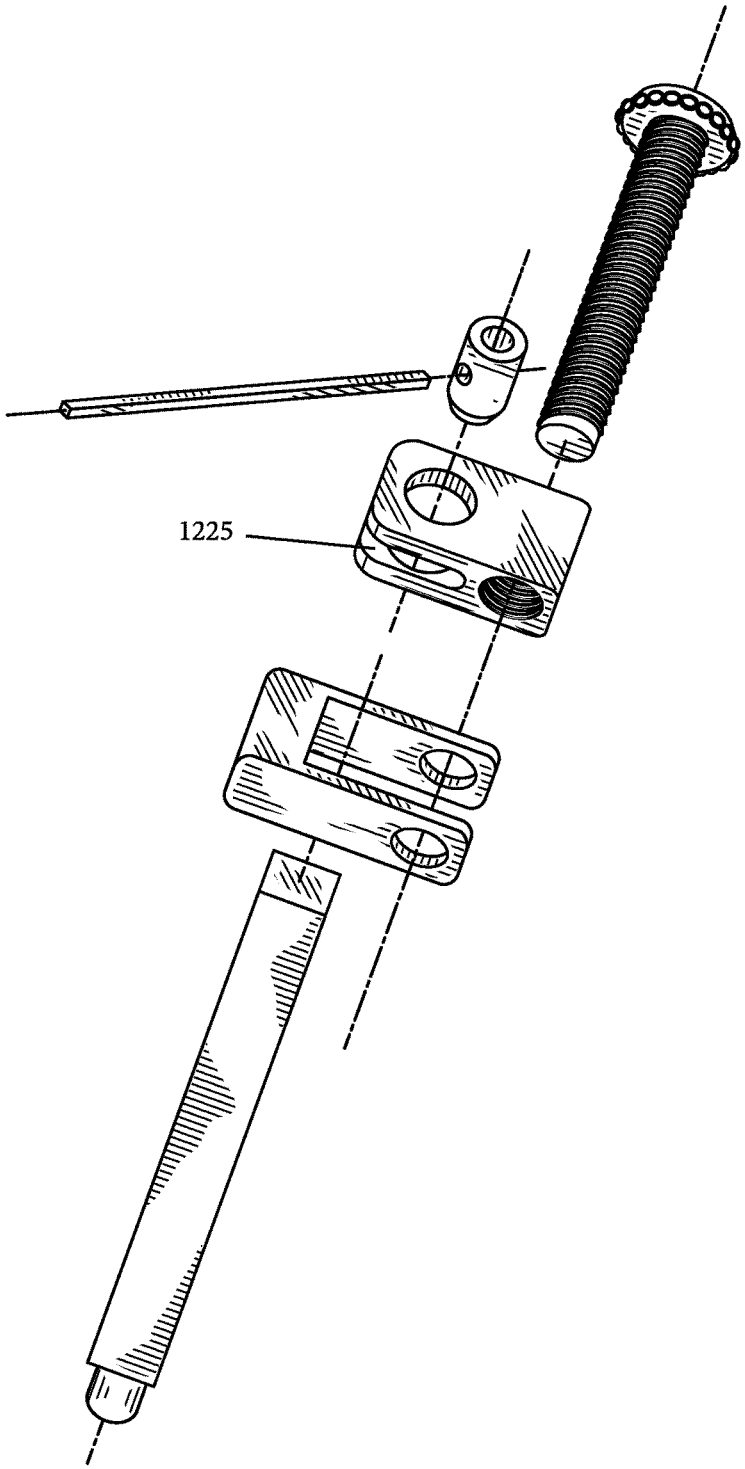


FIG. 3

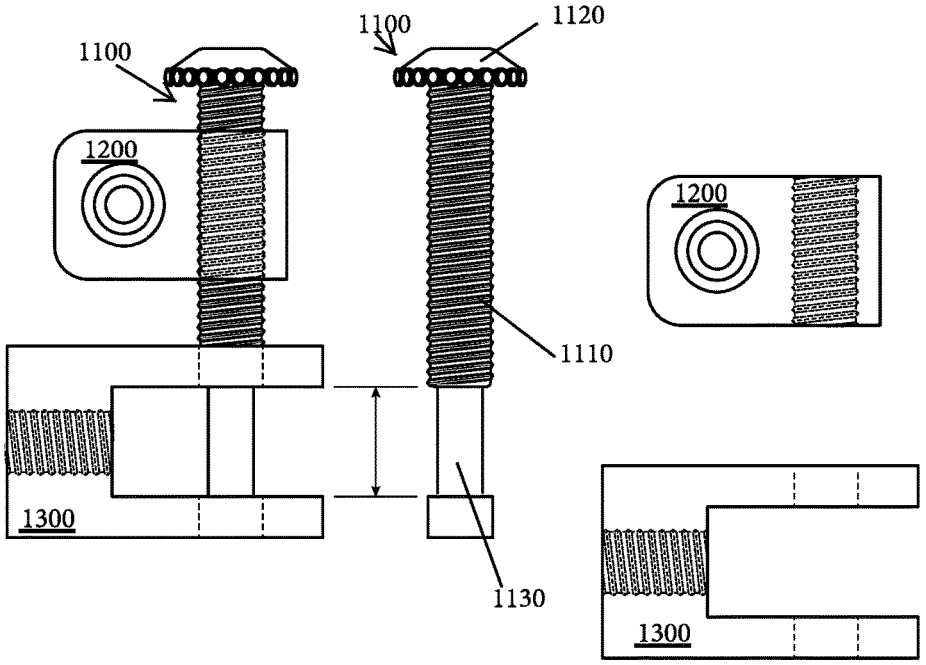


FIG. 4

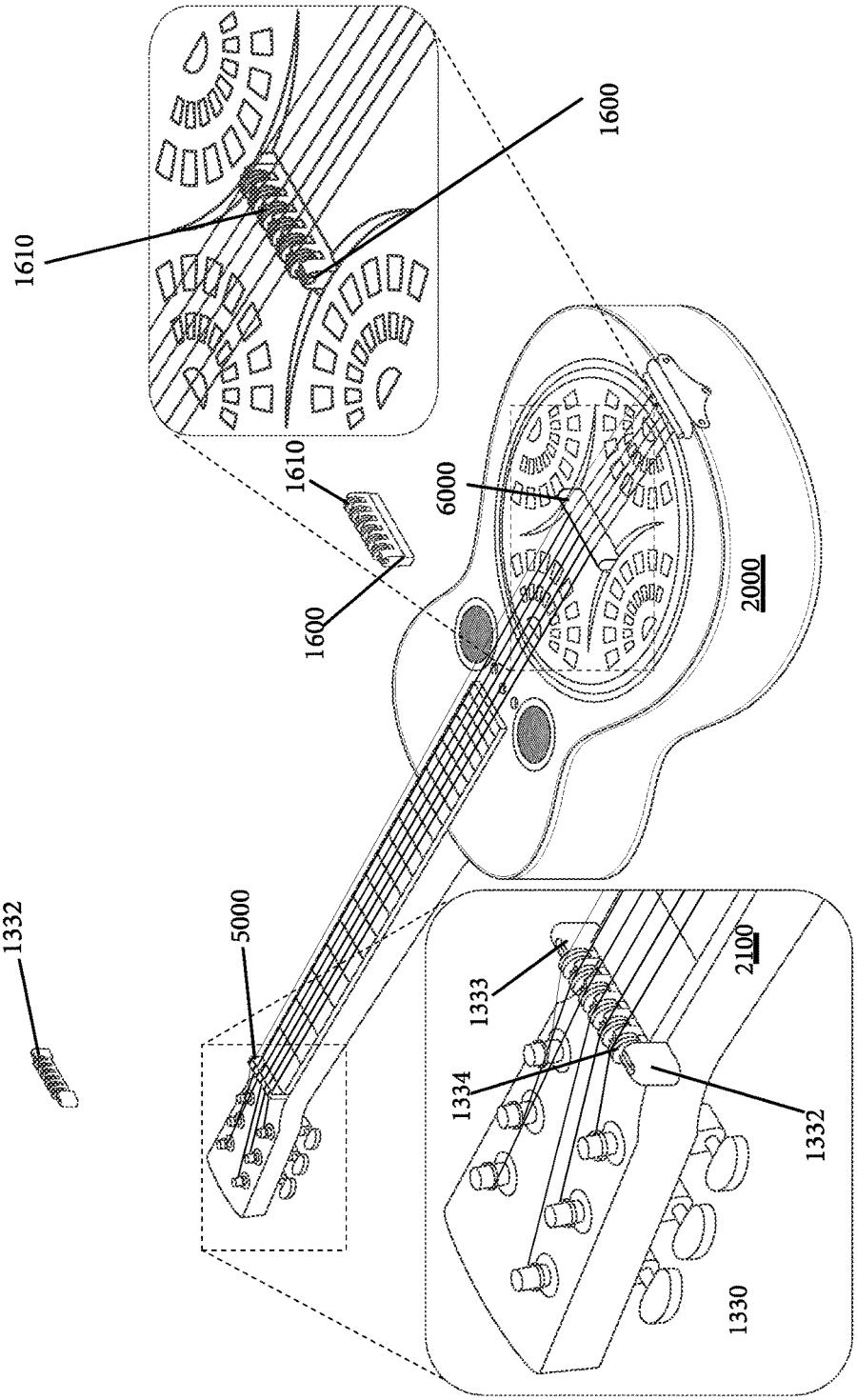

1610
1600
1610
1600
6000
2000
1332
5000
1333
2100
1334
1332
1330

FIG. 5

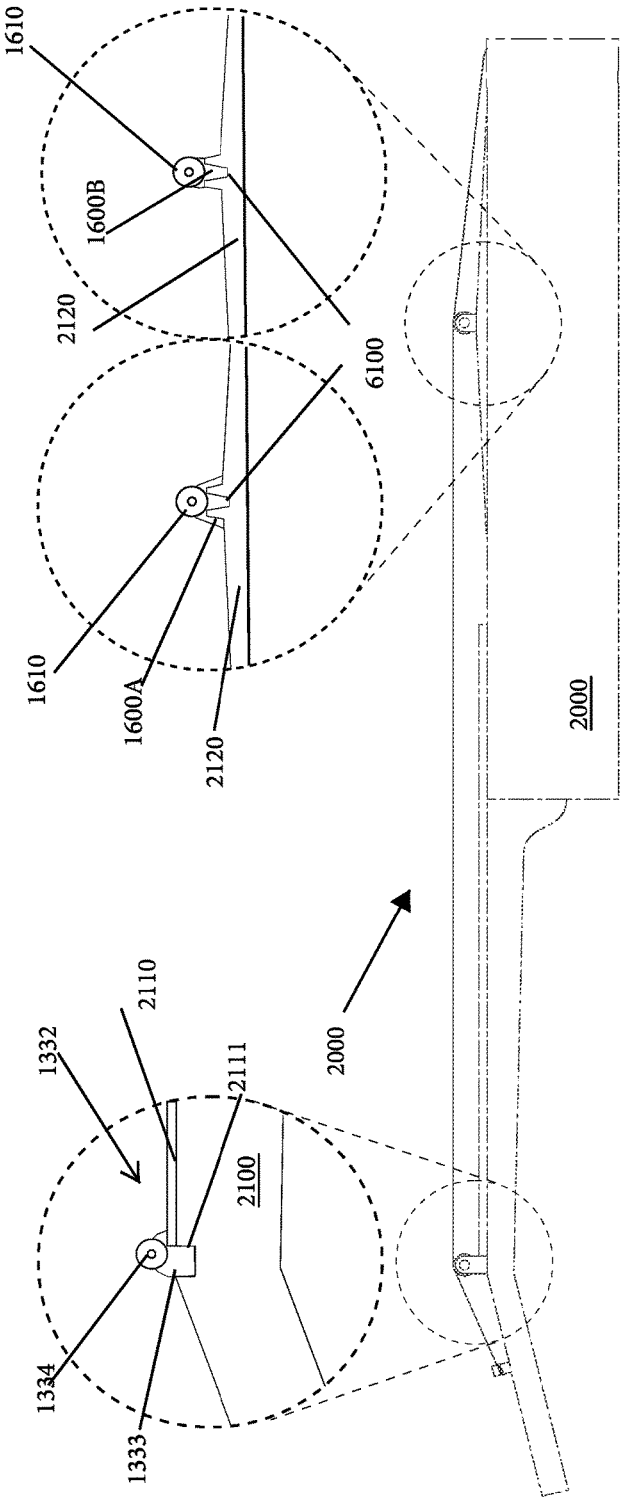


FIG. 6

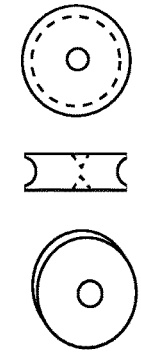


FIG. 9

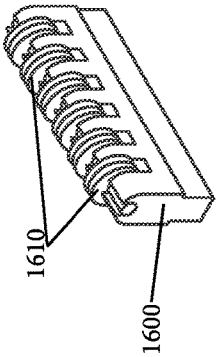


FIG. 8

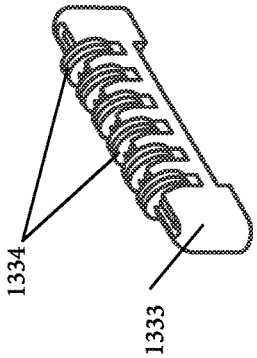


FIG. 7

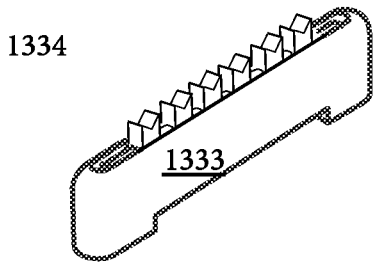


FIG. 10

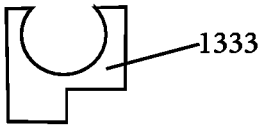


FIG. 11

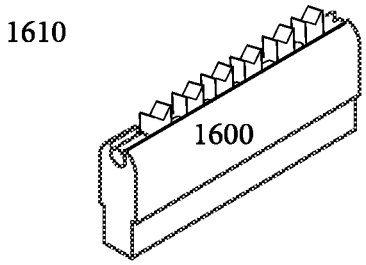


FIG. 12

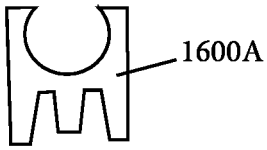


FIG. 13

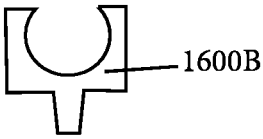


FIG. 14

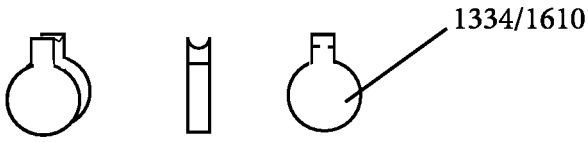


FIG. 15

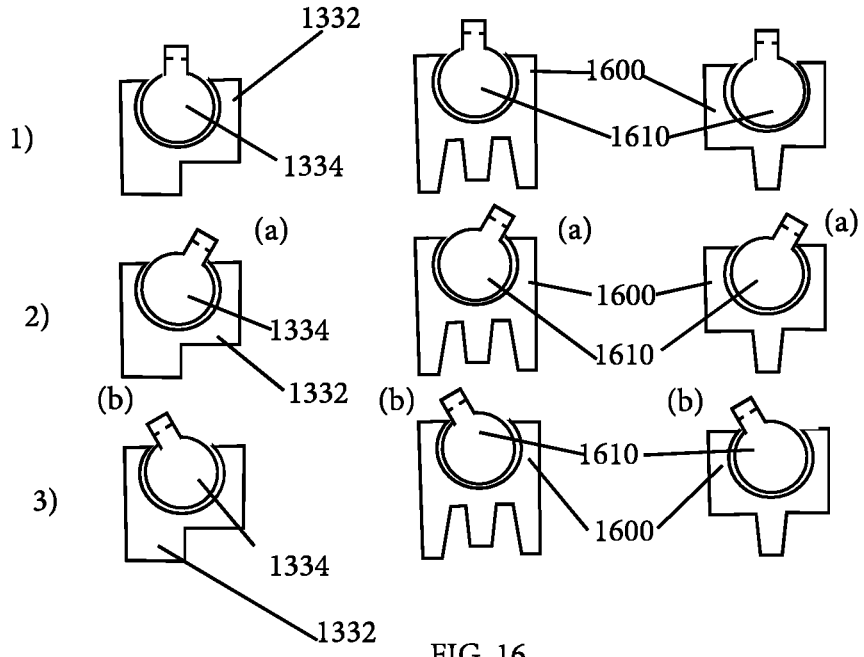


FIG. 16

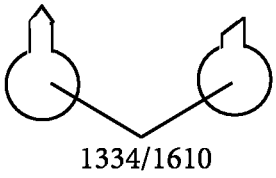


FIG. 16A

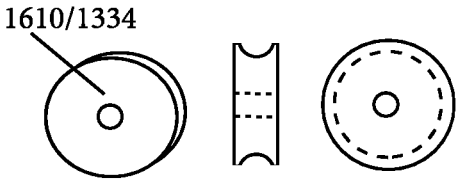


FIG. 17

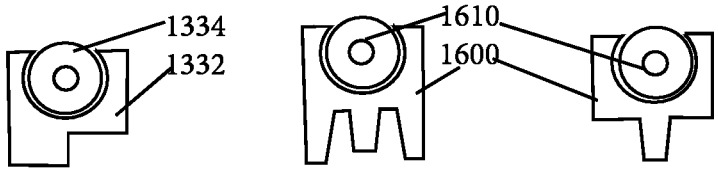


FIG. 18

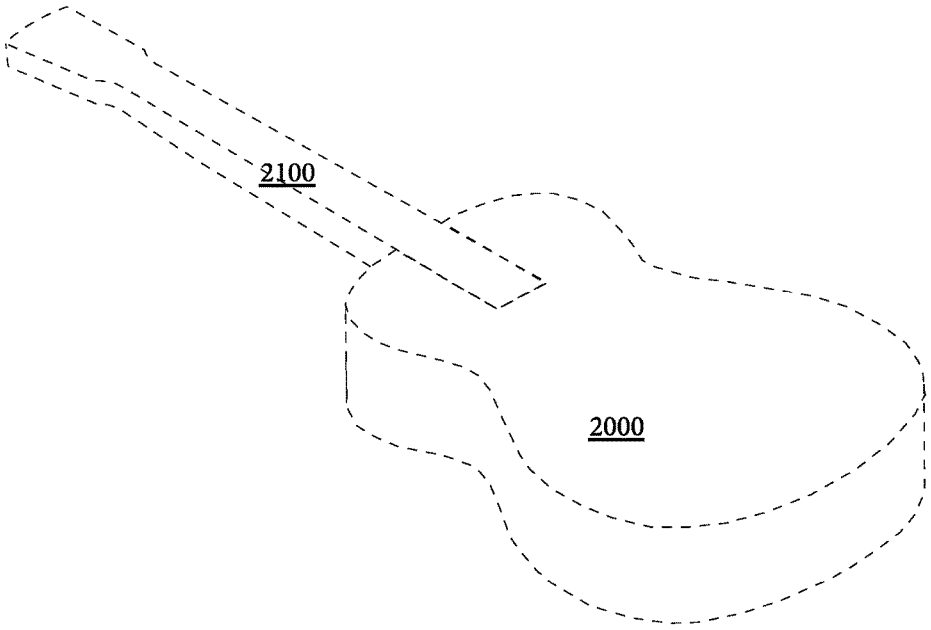


FIG. 19

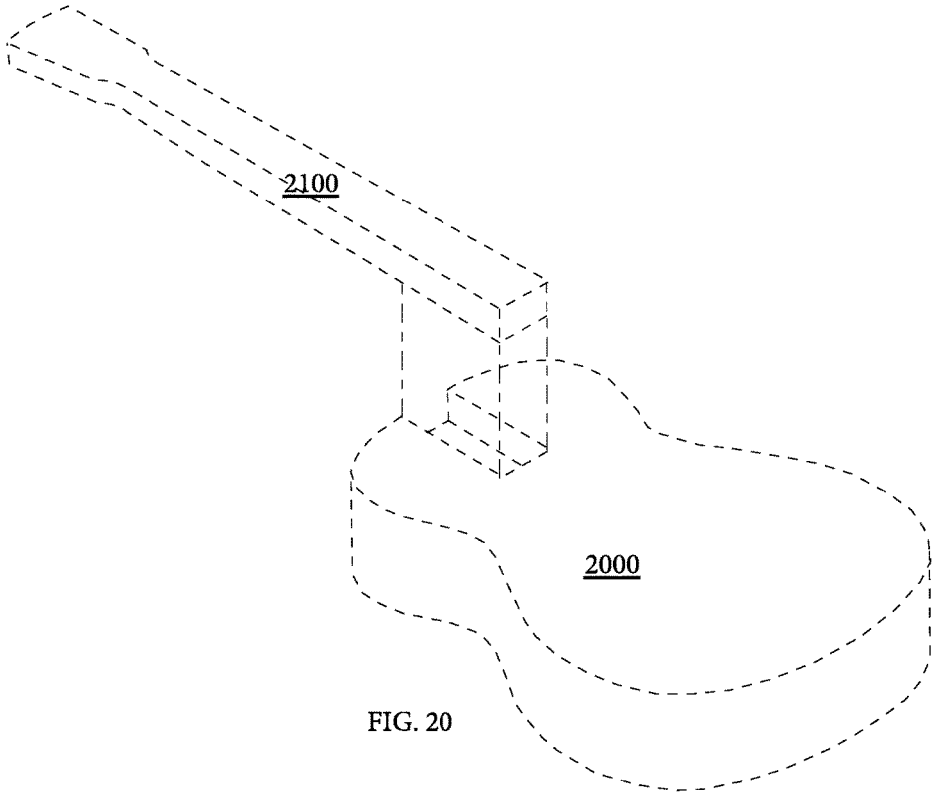


FIG. 20

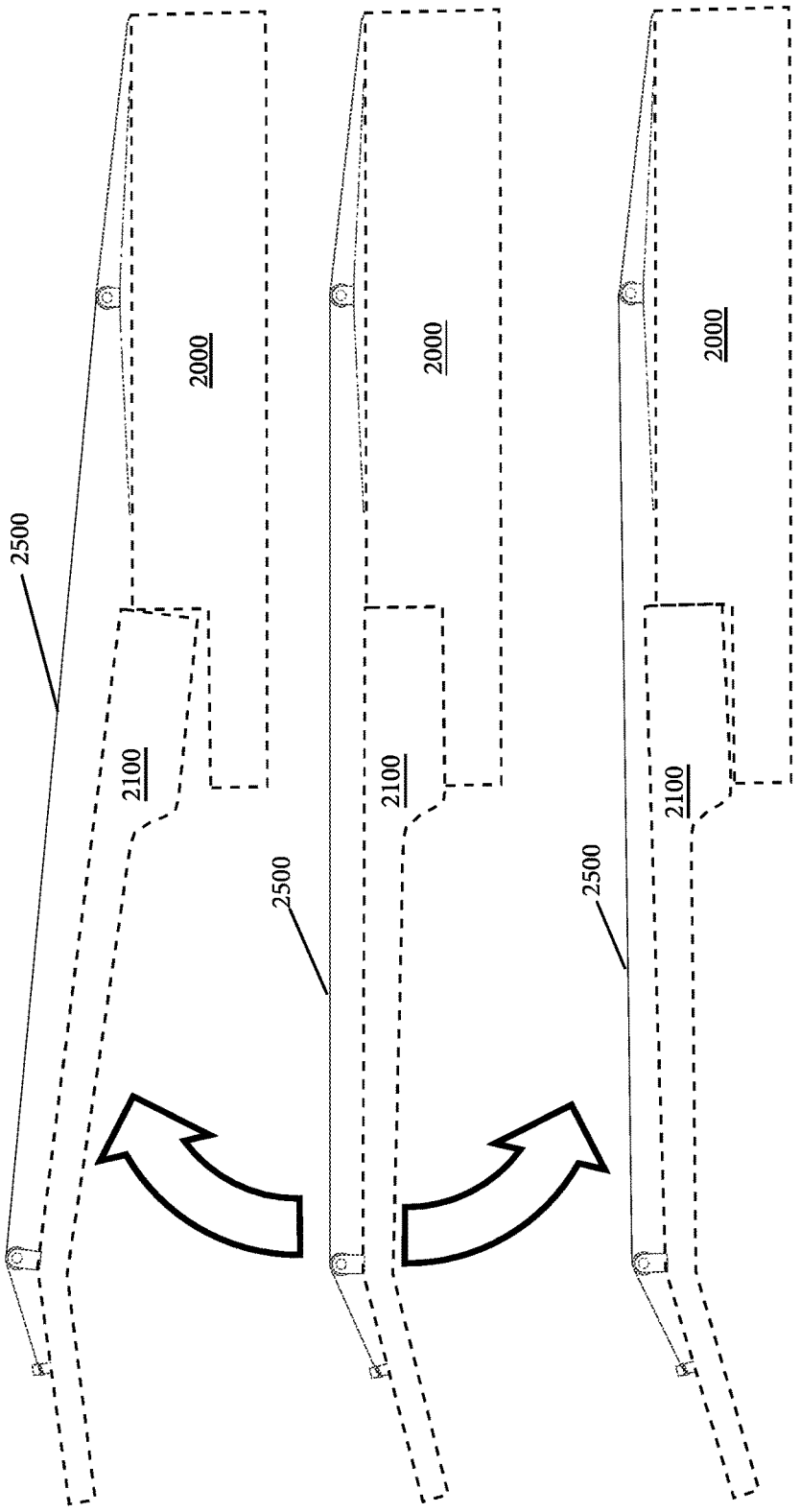
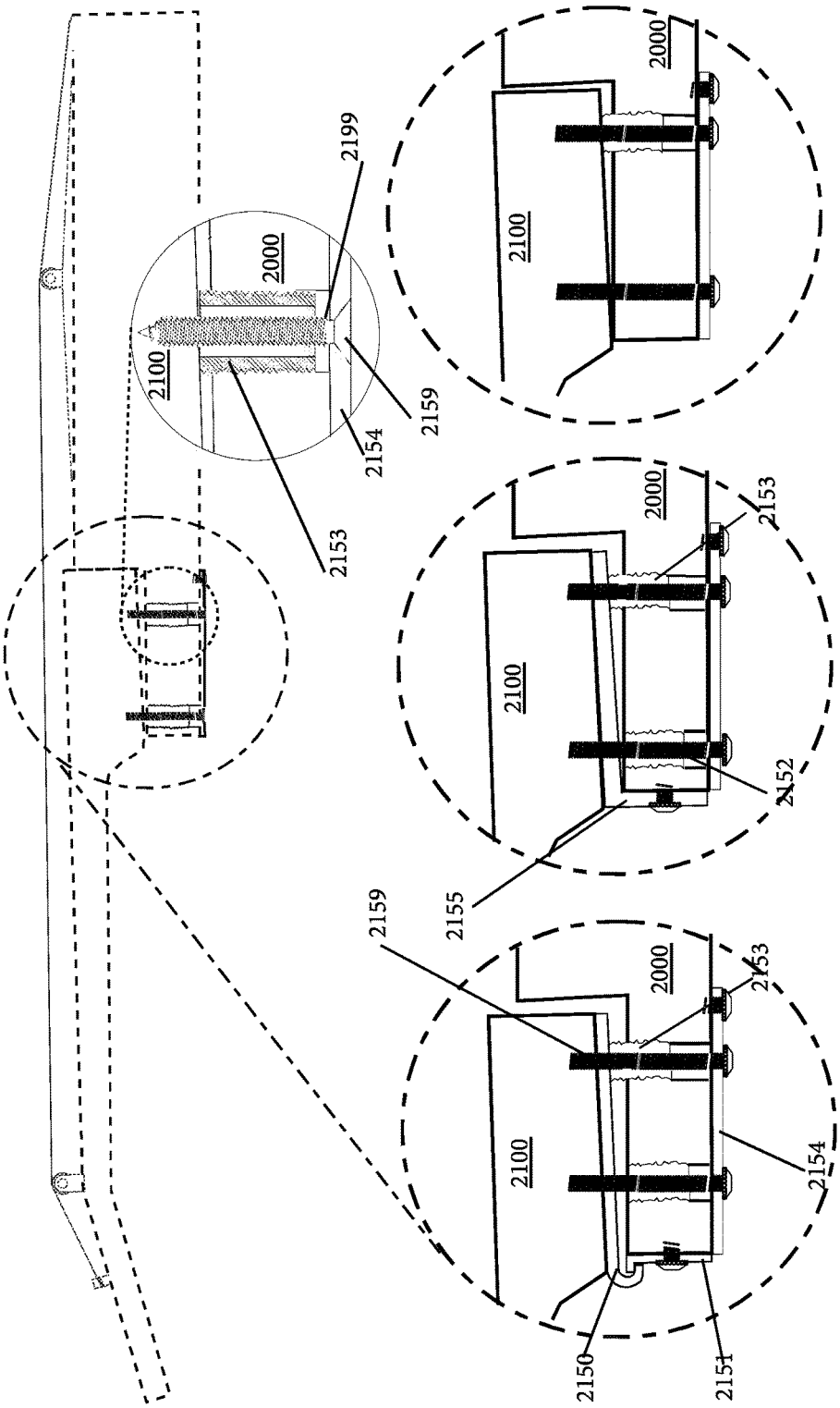


FIG. 21


2000
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2199
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FIG. 22

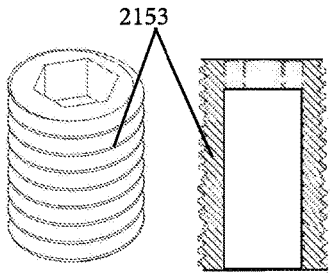

FIG. 22A

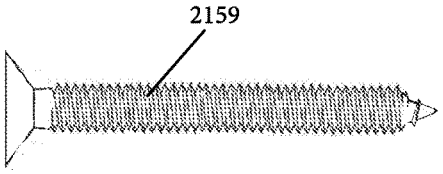

FIG. 22B

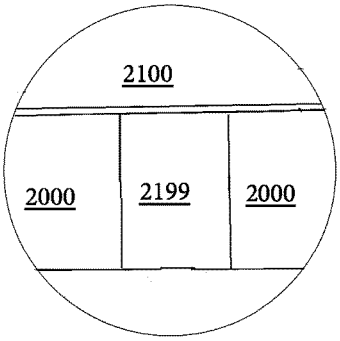

FIG. 22AA

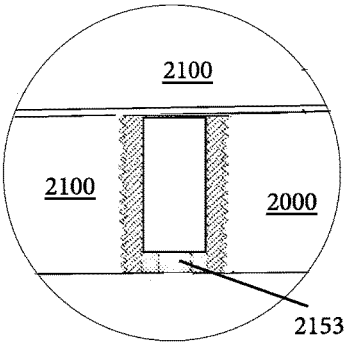

FIG. 22BB

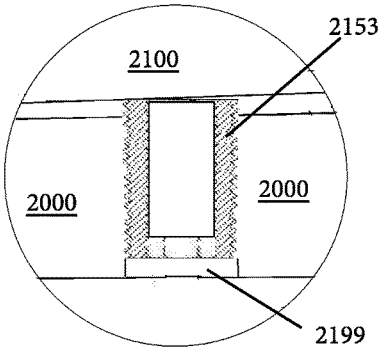

FIG. 22CC

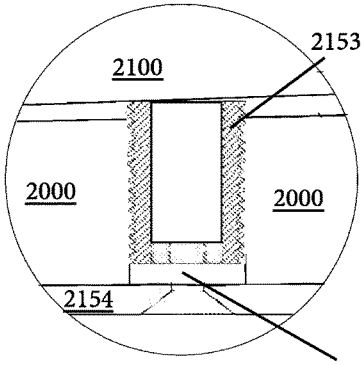

FIG. 22DD

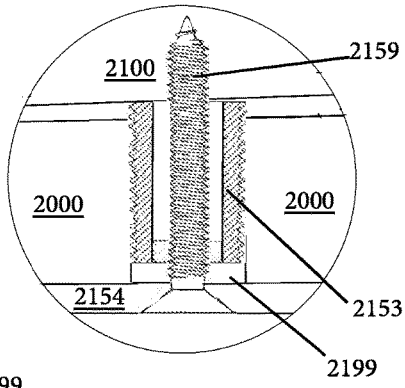

FIG. 22EE

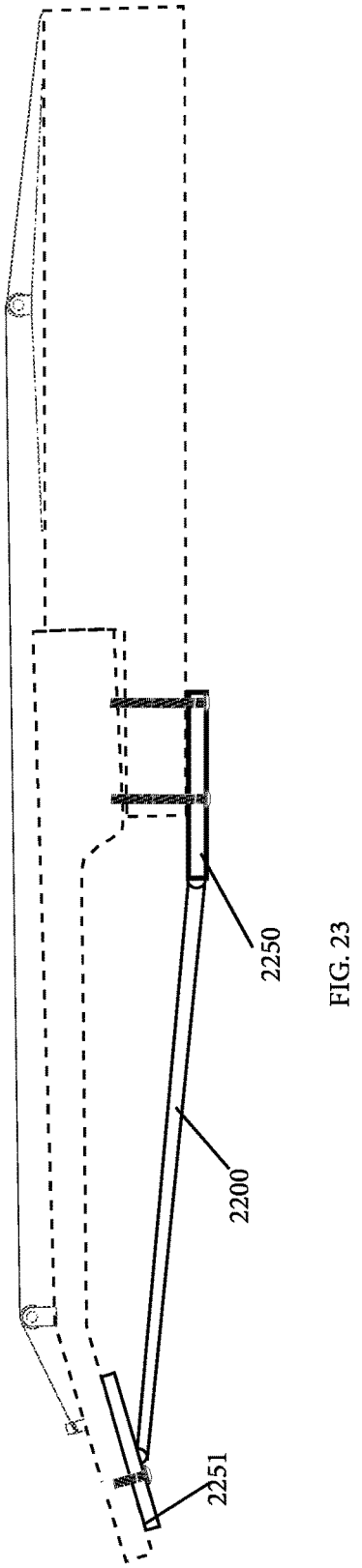

FIG. 23

PITCH CHANGING MECHANISMS FOR STRINGED MUSICAL INSTRUMENTS

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

Not applicable.

REFERENCE TO AN APPENDIX SUBMITTED ON A COMPACT DISC AND AN INCORPORATED BY REFERENCE OF THE MATERIAL ON THE COMPACT DISC

Not applicable.

STATEMENT REGARDING PRIOR DISCLOSURES BY THE INVENTOR OR A JOINT INVENTOR

Reserved for a later date, if necessary.

BACKGROUND OF THE INVENTION

Field of Invention

The disclosed subject matter is in the field of guitar effects. More specifically, this subject matter includes improvements to mechanisms that change the pitch of an instrument's string by raising and/or lowering its tension.

Background of the Invention

Stringed instruments, like guitars, produce sounds via string vibration. The pitch of sound produced by a vibrating string is dependent on many things, including the string's thickness, tension strength, and length. Thus, stringed instruments can have a range of sound pitch when the physical characteristics of their strings can be varied.

FIGS. **1**A and **1**B depict an example of typical pitch changing mechanism **1500** of a guitar **2000**. FIG. **1**A is a cross section of a guitar **2000** with a prior art pitch changing mechanism **1500**. FIG. **1**B is a perspective diagram of the pitch changing mechanism of FIG. **1**A. As shown in FIGS. **1**A and **1**B, the mechanism **1500** is defined by at least one pitch changer **1510** (usually one per string of the instrument **2000**). Suitably, the top of the pitch changer **1510**, which is suitably designed to raise the tension of a string **1510** when activated, incorporates a string catch, for coupling the pitch changer **1510** to a string **2500** of a musical instrument **2000**. As shown in FIG. **1**A, strings **2500** are secured to the key head of an instrument **2000**, passed over the bridge of the guitar **2000** before being mechanically coupled to the pitch changer **1510** via the string catch. Suitably, the connection of the string **2500** to the pitch changer **1510** allows a foot pedal assembly (not shown) to tighten or loosen the string **2500** to produce varied pitch sounds. FIG. **1**B is a partially exploded view of a preferred embodiment of a string pitch changer housing **1500** with a single pitch changer **1510** depicted. Suitably, the pitch changer **1510** is pivotable around the pin **1580**. As shown, the pitch changer **1510** is mechanically coupled to a pull-rod **1590** that is also mechanically coupled to a bell crank **1150** a bell crank finger **1151**. The height of the pull-rod **1590** relative to the crank **1150** and pitch changer **1510** may be manipulated via coupling the pull-rod **1590** to a fixed and preset pull-rod receptacle **1153** (six shown) on one of the fingers **1151**. The bell crank **1150** is mechanically coupled to a pivotable cross-bar **1152** that is controllable via the foot pedal assembly (not shown) so that the cross-bar **1152** of the bell crank **1150** is pivoted, the fingers move correspondingly to pull the pull-rod **1590**, pivot the pitch changer **1510**, and tauten or slacken the string **2500**. Suitably, the a finger **1153** may be positioned variously along the cross-bar **1152** at fixed and preset locations **1154** that effectively align the finger **1153** with the string **2500** on the instrument **2000**.

Problems arise in the typical pitch changing mechanism **1500**. For instance, the fixed and preset pull-rod receptacles **1153** on the crank fingers **1153** do not allow for easy fine tuning of the height of the pull-rod **1590** relative to the crank **1150** and pitch changer **1510**. Similarly, the fixed and preset locations **1154** on the cross-bar **1152** do not allow customized alignment of the finger **1153** with the string **2500** on the instrument. These problems result in a musician being unable to exactly set and manipulate the pitch of a string **2500** to his or her ideal specifications.

SUMMARY OF THE INVENTION

In view of the foregoing, an object of this specification is to disclose pitch changing mechanisms, including fine-tuning and micro adjustment mechanisms. One mechanism is an adjustable tuning rod holder for a stringed instrument that is configured for both (A) fine tuning of the height of a pull-rod relative to a rod puller and pitch changer and (B) alignment the rod puller **1000** with the string **2500** on the instrument **2000**. Other embodiments include roller nut and roller bridge housings. Yet still, disclosed are embodiments of pivot plates for fine or micro adjustments of the angle of a neck of a stringed instrument relative to the instruments body.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Other objectives of the disclosure will become apparent to those skilled in the art once the invention has been shown and described. The manner in which these objectives and other desirable characteristics can be obtained is explained in the following description and attached figures in which:

FIG. **1**A is a cross section of a guitar **2000** with a prior art pitch changing mechanism **1500**;

FIG. **1**B is a perspective diagram of the pitch changing mechanism of FIG. **1**A;

FIG. **1** is cross section of the adjustable tuning rod puller on a guitar **2000**;

FIG. **2** is a perspective view of an adjustable tuning rod puller **1000** of FIG. **1**;

FIG. **3** is an exploded view of the adjustable tuning rod puller **1000** of FIGS. **1** and **2**;

FIG. **4** is a side-by-side of a side view and exploded side view of the adjustable tuning rod puller **1000** of FIGS. **1** through **3**;

FIG. **5** is a perspective view of a guitar **2000** with enlarged views of an installed roller nut **1332** and an installed bridge housing **1600** with brass rollers **1610**;

FIG. **6** is a side view of the guitar **2000** with enlarged cross-sections of the roller nut **1332** and bridge housing **1600**;

FIG. **7** is a perspective view of a roller nut housing with **1333** with brass rollers **1334** FIG. **8** is a perspective view of a roller bridge housing with brass rollers **1610**;

FIG. **9** is a side-by-side perspective, front and side view of a brass roller **1334**/**1610**;

FIG. **10** is a perspective view of an alternate embodiment of roller nut **1332**;

FIG. **11** is a cross section of the roller nut housing **1332** of the roller nut **1332** shown in FIG. **12** is a perspective view of an alternate embodiment of a roller bridge housing;

FIG. **13** is a cross-section of the roller bridge housing **1600** shown in FIG. **12**;

FIG. **14** is an alternative cross section of the roller bridge housing **1600** shown in FIG. **12**;

FIG. **15** is a side-by-side perspective, front and side view of a brass roller **1334**/**1610**;

FIG. **16** is a grid of operation for the roller nut **1332**, roller bridge housings **1600**, and brass roller **1610** shown in FIGS. **10** through **15**;

FIG. **16**A is a view of alternate rollers **1334**/**1610**;

FIG. **17** is a side-by-side perspective, front and side view of a brass roller **1334**/**1610**;

FIG. **18** is a grid of operation for the roller nut housing **1332**, roller bridge housing **1600**, and brass roller **1610** shown in FIGS. **17**;

FIG. **19** is a perspective view of a guitar **2000** with a removable neck **2100**;

FIG. **20** is an exploded perspective view of guitar **2000** and neck **2100** of FIG. **19**;

FIG. **21** is a diagram that illustrates the tilting of the neck **2100** of a guitar **2000** of FIGS. **19** and **20**;

FIG. **22** is a diagram that illustrates the mechanisms for accomplishing the tilting of a neck **2100** of a guitar **2000**;

FIG. **22**A is a perspective and cross section of neck pitch adjustment screw **2153**;

FIG. **22**B is a side view of neck screw **2159**;

FIG. **22**AA is a zoom in of FIG. **22**;

FIG. **22**BB is a zoom-in view of FIG. **22**;

FIG. **22**CC is a zoom-in view of FIG. **22**;

FIG. **22**DD is a zoom in view of FIG. **22**;

FIG. **22**EE is a zoom in view of FIG. **22**; and,

FIG. **23** is a side view of a neck support brace **2200**.

In the figures, the following reference numerals represent the corresponding component:

1000—adjustable tuning rod puller;
1100—thumb-screw;
1150—bell crank;
1151—bell crank finger;
1152—cross-bar;
1200—pull-rod holder;
1210—rotating pull-rod collar with lock-screw;
1220—pull-rod;
1225—pull-rod slit;
1230—threaded aperture for the thumb-screw **1100**;
1300—C-shaped anchor;
1310—thumb-screw receptacle;
1320—set-screw port;
1332—roller nut;
1333—roller nut housing;
1334—brass rollers;
1400—cross-rod;
1500—pitch changer assembly;
1510—pitch changer;
1580—pin;
1600—bridge housing;
1610—rollers;
1900—foot-pedal rod;
2000—guitar or other stringed instrument;
2100—neck of the guitar;
2150—neck pivot plate;
2151—body pivot plate;
2152—pivot screw;
2153—neck pitch adjustment screw;
2154—body plate;
2155—holes in the pivot plates;
2159—neck screw;
2199—threaded hole;
2200—neck support brace;
2250—support body plate;
2251—support head plate;
2500—string;
5000—nut; and,
6000—bridge.

It is to be noted, however, that the appended figures illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments that will be appreciated by those reasonably skilled in the relevant arts. Also, figures are not necessarily made to scale but are representative.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The Adjustable Tuning Rod Puller **1000**.

FIG. **1** is a contextual view of an adjustable tuning rod puller **1000** installed on a guitar **2000**. As shown, the adjustable tuning rod puller **1000** suitably provided to the underside of the guitar **2000** and configured to, as discussed below, pivot in response to interaction with a foot pedal rod **1900**. The adjustable tuning rod puller **1000** is suitably coupled to a pull rod **1220** that is mechanically coupled to a pivotable pitch changer **1510** at the butt of the guitar **2000**. Suitably, a string **2500** from the key head of the guitar **2000** is coupled to the pitch changer **1510**. In its most basic mode, the adjustable tuning rod puller **1000** may be installed and pivoted via action of the pedal rod **1900** to pull the pull rod **1220**, pivot the pitch changer **1510**, and pull or slacken the string **2500** of the guitar **2000**. As discussed below, the adjustable tuning rod puller **1000** is configured for both (A) fine tuning of the height of the pull-rod **1590** relative to the rod puller **1000** and pitch changer **1510** and (B) aligning the rod puller **1000** with the string **2500** on the instrument **2000**.

FIG. **2** is a perspective view of an adjustable tuning rod puller **1000**. FIG. **3** is an exploded view of the adjustable tuning rod puller **1000** of FIGS. **1** and **2**. FIG. **4** is a side-by-side of a side view and exploded side view of the adjustable tuning rod puller **1000** of FIGS. **1** through **3**. As shown in these figures, the adjustable tuning rod puller **1000** comprises four main sub-components: (1) the thumb screw **1100**; (2) the pull-rod holder **1200** and pull rod **1220**; (3) the C-shaped anchor **1300**; and (4) the cross-rod or cross-bar **1400**.

As shown in FIG. **2** through **4**, the thumb screw **1100** is a threaded rod **1110** with a head **1120** and spacer **1130**. Still referring to said figures, the pull-rod holder **1200** is a rectangular block with a threaded thumb screw aperture **1230**, a pull-rod slit **1225**, a rotating pull-rod collar **1210**

with lock-screw that rotatably spans the pull rod slit **1225**; and a pull rod **1220**. Suitably, the pull rod **1220** is configured to enter the slit and be provided to the pull rod collar **1210** and locked in place. Yet still referring to the figures, the c-shaped anchor **1300** may suitably be a c-shaped block with a thumb screw receptacle **1310** across the arms of the c-shape block, a set screw port **1320** through the back end of the c-shaped block, and where the arms are configured to receive the cross-bar **1400** therebetween. Finally, the cross-bar **1400** is suitably a square bar. As shown, the cross bar **1400** is configured to be locked in between the arms of the c-shaped anchor **1300** via a set screw (not shown) through port **1320** that sets the cross bar **1400** against the spacer **1130** of the thumb screw **1100**. It should be noted the pull rod **1220** could be secured via a right angle bent rod instead of a pull-rod collar **1210** where the right angle rod could be provided through the pull rod holder and clipped on the other side.

Referring to FIGS. **1** through **4**, the location of the pull rod holder **1200** along the thumb screw **1100** may be manipulated via turning the thumb screw **1100** relative to the pull rod holder **1200**. In this way, fine tuning of the height of the pull-rod **1590** relative to the rod puller **1000** and pitch changer **1510** may be accomplished. Still referring to FIGS. **1** through **4**, the location of the c-shaped anchor along the cross-bar **1400** may be manipulated via providing the cross-bar **1400** between the arms of the c-shaped anchor to a desired position and setting the set screw through the screw port **1320** until the cross-bar **1400** is set against the spacer **1130** of the thumb screw **1100**. In this way, alignment of the rod puller **1000** with the string **2500** on the instrument **2000** can be accomplished.

The Roller Nut Assembly **1332** and the Bridge Housing **1600**

FIG. **5** is a perspective view of a guitar **2000** with enlarged views of an installed roller nut **1332** and an installed bridge housing **1600** with brass rollers **1610**. FIG. **6** is a side view of the guitar **2000** with enlarged cross-sections of the roller nut **1332** and bridge housing **1600**. In one embodiment, a bridge housing **1600** with brass rollers **1610** replaces the existing bridge on the stringed musical instrument **2000**. Correspondingly, a roller nut assembly **1332**, which consists of roller nut housing **1333** and brass and gauged rollers **1334**, is installed in the neck **2100** of the guitar **2000**. In this embodiment, the roller nut **1332** replaces the nut of the guitar **2000** that is adjacent to the keyhead of the guitar **2000**. Suitably, the roller nut assembly **1332** will fit into the groove that results from removal of said nut **5000**, as shown.

As shown, the figures (FIGS. **5** and **6**) illustrate the replacement of a standard nut **5000** and a standard bridge **6000** with respectively a roller nut assembly **1332** and a bridge housing **1600** with brass rollers **1610**. Suitably, the standard nut **5000** may be removed from the neck **2100** of the guitar so that a slot **2111** is exposed adjacent to the fret board **2110** (see FIG. **6**) where the housing **1333** of the roller nut assembly **1332** may be provided into the slot **2111** for completing installation. Concurrently, the standard bridge nut **6000** may be removed to expose a spider nut groove **6100**, whereafter one embodiment of a bridge housing **1600**A may be provided over and into the spider nut groove **6100** or an alternate embodiment of the bridge housing **1600**B may be provided into the spider nut groove **6100** (shown in FIG. **6**). In other words, bridge housing **1600** either rests (a) on the outside of the spider groove **6100** via receipt of the spider groove **6100** or (b) on the inside of the groove **6100** via insertion. Thus, the roller nut assembly **1332** and bridge housing **1600** may replace a standard nut **5000** and bridge **6000**.

FIG. **7** is a perspective view of the roller nut housing with **1333** with brass rollers **1334** shown in FIG. **6**. FIG. **8** is a perspective view of a roller bridge housing **1600**A or **1600**B with brass rollers **1610** shown in FIG. **6**. As shown, the brass rollers **1334** and brass rollers **1610** are rotatable around central shaft positioned respectively in the nut housing **1334** or bridge housing **1600**. In an alternate embodiment, each brass roller **1334/1610** could be rotatable around between pointed set screws.

FIG. **9** is a side-by-side perspective, front and side view of a brass roller **1334/1610**. As shown, the rollers may suitably be a disc with a groove for receiving a string around the outside edge. In one embodiment, the groove is round in cross section and configured to receive a round string. In a preferred embodiment (shown in the front and side view of the brass roller **1334/1610**) the brass roller is configured to receive a pin or shaft through the center for providing an axis about which the roller **1334/1610** may rotate.

FIG. **10** is a perspective view of an alternate embodiment of roller nut **1332**. FIG. **11** is a cross section of the roller nut housing **1332** of the roller nut **1334** shown in FIG. **10**. FIG. **12** is a perspective view of an alternate embodiment of a roller bridge housing **1600**. FIG. **13** is a cross-section of the roller bridge housing **1600** shown in FIG. **12**. FIG. **14** is an alternative cross section of the roller bridge housing **1600** shown in FIG. **12**. FIG. **15** is a side-by-side perspective, front and side view of a brass roller **1334/1610**. As shown in these figures, the roller nut housing **1332** and bridge housing **1600** are installed on a guitar in substantially the same manner shown and described in connection with FIG. **6**. A primary structural feature of the present roller nut housing **1332**, bridge housing **1600** and brass roller **1334/1610** shown in FIGS. **10** through **15** is that the rollers **1334/1610** reside in slots cut into the housing and operate without a shaft axle. As shown in FIG. **15**, the roller **1334/1610** features a leg grooved for the string where the leg will rock (move) with the string when the string is pulled.

FIG. **16** is a grid of operation for the roller nut **1332**, roller bridge housings **1600**, and brass roller **1610** shown in FIGS. **10** through **15**. In normal operation, strings of a musical instrument move a max of 0.062 inches and a minimum of 0.015 inches in response to tuning changes or when strings are pulled by pitch changers. This embodiment of a roller and housing accommodate string movement by moving the roller in the direction of the string automatically in response to string pressure. In a preferred embodiment, the groove of the rollers may be concentric. In the grid, the left column shows a roller **1334/1610** inside of the roller nut housing **1332**, the center column shows the roller **1334/1610** inside of a housing **1600** shown in FIG. **13**, the right column shows a roller in **1334/1610** in a housing **1600** shown in FIG. **14**, row **1**) shows the roller **1134/1610** in a central position, row **2**) shows the roller **1334/1610** in forward stop position, and row **3**) shows the roller **1334/1610** in a rearward stop position. As shown in FIG. **15**, the roller **1334/1610** features a leg grooved for the string where the leg will rock (move) with the string when the string is pulled. This rocking motion is shown in the grid, referring to row **1**) of FIG. **16**, a string (not shown) may be positioned over a roller **1334/1610** in a central position so that if the string (not shown) is pulled forward, the roller **1334/1610** will rock to the forward position of row **2**). Alternatively, the roller **1334/1610** will rock to the rearward position of row **3**) when the string (not shown) is pulled rearward. Suitably, the leg of the roller will

stop movement when contacting the edges (a) and (b) so that the scale of the string can be controlled. Suitably, the string may slide through the grove as in connectional tuning when the string is tuned beyond the edges (a),(b). Suitably, the rollers **1334/1610** are configured to auto-adjust between the two edges (a), (b) during usage. In operation, the rollers will roll back and forth when strings are pulled by pitch changers. In a forward stop position (b), the string will hold on scale, and move to a rearward stop position (a) during manipulation of the a pitch changer. However, string pressure will cause the roller to return to a forward stop position (b) automatically when the pull of the string changer is released. FIG. **16**A shows an alternate embodiment of the rollers **1334/1610**. As shown in FIG. **16**, the rollers move between point (a) and (b) during pitch changes. That distance is typically never more than 1/16 of an inch. So, the contact point of the string and the roller **1134/1610** may suitably define an edge so that dampening of the string is lessened.

FIGS. **17** and **18** illustrate an alternate embodiment of the housing **1332**, **1600** and roller **1334**, **1610** where the leg is not included on the roller **1334/1610**. In a preferred embodiment, the housing **1332**, **1600** may feature receptacle for the roller **1334**, **1610** that is about 0.010 to 0.015 inches larger diameter than the string roller **1334**, **1610**. Suitably, the string roller **1334**, **1610** may be configured with a shaft axis so that the roller may float within the housing **1332**, **1600** by being suspended therein on a shaft. Suitably, suspension of the roller on a shaft keeps the string roller **1334**, **1610** of the housing, thus, allowing the string roller to freely move about the shaft axis and in within the housing **1332**, **1600**. The above roller system provides miniature housing dimensions for housing string rollers and could be made much cheaper by utilizing extruded housings and screw machined rollers as well as easy installation. Outside larger rollers could be staked to the housing to keep the assembly together. In the alternate embodiment shown in FIGS. **17** and **18**, the rollers maintain a scale at all times because the roller is concentric with the housing **1334/1600**.

The Pivot Plate **2150** and Other Mechanisms for Tilting a Guitar Neck **2100** Relative to the Guitar **2000**

FIG. **19** is a perspective view of a guitar **2000** with a removable neck **2100**. FIG. **20** is an exploded perspective view of guitar **2000** and neck **2100** of FIG. **19**. As shown, a butt of the neck is provided into a corresponding slot of the guitar **2000**. FIG. **21** is a diagram that illustrates the tilting of the neck **2100** of a guitar **2000** of FIGS. **19** and **20**. Referring to this diagram, the angle of the neck **2100** may be adjusted relative to the body **2000**. In some instances, the angle of the neck **2100** may be adjusted relative to the body **2000** to either (i) fine-tune or micro adjust the pitch of the guitar strings or (ii) adjust the height of the strings **2500** relative to the neck **2100** and guitar **2000**. Those of skill in the art will appreciate the fine tuning of strings. The height of the strings **2500** relative to the neck **2100** and body **200** can be increased via tilting the neck upward (top of FIG. **21**) and decreased via tilting the neck downward (bottom of FIG. **21**). Suitably, string height may be adjusted to a musician's preference or to accommodate higher bridges by tilting the neck as described herein.

FIG. **22** is a diagram that illustrates the mechanisms for accomplishing the tilting of a neck **2100** of a guitar **2000** shown in FIG. **21**. The figures feature four zoom-in views that illustrates three embodiments of tilting mechanisms. As shown, tilting may be accomplished according to three alternative embodiments. In a first embodiment shown in the far left zoom-in view, tilting is accomplished via a neck pivot plate **2150**, a body pivot plate **2151**, a neck pitch adjustment screw **2153**, and a body plate **2154** and at least one neck screw **2159**. Suitably, the neck pivot plate **2150** may be provided to the butt of the neck **2100** and the body pivot plate **2151** may be provided on adjacent to the neck receptacle of the guitar **2000**. As shown, the neck pivot plate **2150** suitably features a hook or grove portion that is configured to receive a tongue portion of the body pivot plate **2151** when the neck **2100** is positioned into the receptacle of the guitar **2000**. In a preferred embodiment, a neck pitch adjustment screw **2153** may be provided to body **2000** that may be manipulated via a wrench (e.g. Allen wrench) to move the neck up or down relative to the pivot screw. Suitably, the neck **2100** will tilt according to the manipulation of the neck pitch adjustment screw **2153** while the tongue and groove action of the neck pivot plate **2150** and body plate **2151** interact to ensure that the neck **2100** does not destructively interact with the body **2000** during pitch adjustments. Furthermore, the hook and groove of the neck pivot plate **2150** and body plate **2151** enable adjustment of the neck pitch without the screws **2152**, **2153** installed so that an ideal pitch or string height may be assessed quickly and then set by installing the screws. The neck pivot plate further protects the neck so that the screws do not destructively interact with the neck **2100** during pitch adjustments. The body plate **2154** suitably prevents the screws from destructively interacting with the body **2000** by providing a seat for the screws. Once the pivot of the neck **2100** is at a desirable position, the neck screw **2159** may be provided through the neck pitch adjustment screw **2153** and into the neck **2100** to lock the neck to the body **2000** (see the upper right zoom-in view). The neck pitch adjustment screw **2153** and set screw are shown in more detail in FIGS. **22**A and **22**B. As shown in FIG. **22**A, the neck pitch adjustment screw **2153** is an inner-hole screw with an Allen-wrench type receptacle above the smooth (unthreaded) inner bore. The neck pitch adjustment screw **2153** is configured for insertion into a threaded hole or bushing **2199** in the guitar **2000**. The neck screw **2159** is a typical screw and is configured for insertion through the guitar **2000** via the inner hole of the pitch adjustment screw **2153** and into the neck **2100**.

The center zoom-in view shows an alternate embodiment where a spring steel pivot plate **2155** is provided between the neck **2100** and the body **2000**. In this embodiment, the may suitably pivot, as described above, around the pivot screw **2152** and bend in the spring plate **2155** via action of the neck pitch adjustment screw **2153**. As shown in the far right zoom-in view, the tilting may be accomplished without any pivot plates. In a preferred embodiment, holes in the pivot plates **2150**, **2155** for the neck pitch adjustment screws **2153** may be threaded for 3/8 set screws.

FIGS. **22**AA through **22**EE show how the pitch of the neck may be manipulated. Each of FIGS. **22**AA through **22**EE show the center zoom-in view of FIG. **22** at different stages of installation and neck **2100** pitch adjustment. In operation, the pitch of a string may be adjusted as follows. First, a pivot screw **2152** (shown in FIG. **22**) may be loosened a 1/4 turn while the guitar strings are tuned. In some embodiments, two pivot screws will be employed and both would need to be loosened. Second, the neck pitch adjustment screw **2153** will be provided through the bushing **2199** of the guitar **2000** (FIGS. **22**AA to **22**BB) adjusted to the proper height above the body (FIG. **22**CC). The neck plate **2154** may be already installed or put on the guitar at this point, as shown in FIG. **22**DD. As with the pivot screws **2152**, some embodiments could include two neck pitch

adjustment screw **2153** and both would be adjusted in this step. Suitably, an Allen wrench, may be inserted into the empty bushings so that the top of the neck pitch adjustment screw **2153** pitch of the neck may be adjusted upward or downward. Third, the neck screw **2159** may be placed through the neck pitch adjustment screws **2153** at the proper pitch of the neck and the pivot screws **2152** tightened (FIG. **22**EE). In one embodiment the bushings **2199** are threaded ⅜-16 with a 3/16 hole for screw to pace though and secure to the neck of the top bushing after the pitch is adjusted.

FIG. **23** illustrates a side view of a guitar **2000** and neck **2100** with a neck support brace **2200** installed between the body **2000** and the head of the neck **2100**. As shown the brace **2200** is defined by a truss **2252**, a support body plate **2250**, and a support head plate **2251**. In a preferred embodiment, the truss **2252** may be tightened to offset string pressures when the strings **2500** are tightened via pitch changers. In a preferred embodiment the support body plate **2250** may be secured to the body of a guitar **2000** while the support head plate **2251** is secured to the head. The truss **2252** suitably stabilizes the neck **2100** from moving upward which a pitch changer is applied to the stings. Suitably, without the counterbalance of the truss **2252**, the key head may lift up and relax all the strings **2500** when even one of the strings **2500** is pulled taut by a pitch changer.

Although the method and apparatus is described above in terms of various exemplary embodiments and implementations, it should be understood that the various features, aspects and functionality described in one or more of the individual embodiments are not limited in their applicability to the particular embodiment with which they are described, but instead might be applied, alone or in various combinations, to one or more of the other embodiments of the disclosed method and apparatus, whether or not such embodiments are described and whether or not such features are presented as being a part of a described embodiment. Thus the breadth and scope of the claimed invention should not be limited by any of the above-described embodiments.

Terms and phrases used in this document, and variations thereof, unless otherwise expressly stated, should be construed as open-ended as opposed to limiting. As examples of the foregoing: the term "including" should be read as meaning "including, without limitation" or the like, the term "example" is used to provide exemplary instances of the item in discussion, not an exhaustive or limiting list thereof, the terms "a" or "an" should be read as meaning "at least one," "one or more," or the like, and adjectives such as "conventional," "traditional," "normal," "standard," "known" and terms of similar meaning should not be construed as limiting the item described to a given time period or to an item available as of a given time, but instead should be read to encompass conventional, traditional, normal, or standard technologies that might be available or known now or at any time in the future. Likewise, where this document refers to technologies that would be apparent or known to one of ordinary skill in the art, such technologies encompass those apparent or known to the skilled artisan now or at any time in the future.

The presence of broadening words and phrases such as "one or more," "at least," "but not limited to" or other like phrases in some instances shall not be read to mean that the narrower case is intended or required in instances where such broadening phrases might be absent. The use of the term "assembly" does not imply that the components or functionality described or claimed as part of the module are all configured in a common package. Indeed, any or all of the various components of a module, whether control logic or other components, might be combined in a single package or separately maintained and might further be distributed across multiple locations.

Additionally, the various embodiments set forth herein are described in terms of exemplary block diagrams, flow charts and other illustrations. As will become apparent to one of ordinary skill in the art after reading this document, the illustrated embodiments and their various alternatives might be implemented without confinement to the illustrated examples. For example, block diagrams and their accompanying description should not be construed as mandating a particular architecture or configuration.

All original claims submitted with this specification are incorporated by reference in their entirety as if fully set forth herein.

I claim:

1. A system of pivot plates for fine or micro adjustments of the angle of a neck of a stringed instrument relative to a body of the instrument, the system comprising:

a. a neck pivot plate;

b. a body plate;

c. a body pivot plate;

d. at least one pivot screw through the body plate, through the body of the instrument, through the neck pivot plate, and into the neck of the instrument;

e. a height or pitch adjustment screw in the body of the instrument and abutted with the neck pivot plate;

f. at least one set screw through the body plate, through the body of the instrument via an inner hole of said height or pitch adjustment screw, through said neck plate, and into said neck.

2. The system of claim **1** wherein the neck pivot plate is provided to a butt of the neck and the body pivot plate is provided on the body, adjacent to a neck receptacle of the instrument.

3. The system of claim **2** where the neck pivot plate features a hook or grove portion that is configured to receive a tongue portion of the body pivot plate when the neck is positioned into the receptacle of the instrument.

4. A system for fine or micro adjustments of the angle of a neck of a stringed instrument relative to a body of the instrument, the system of comprising at least:

a. a body plate that is secured to the body of the stringed instrument wherein said body features a neck receptacle of the stringed instrument;

b. a height or pitch adjustment screw movable within the body of the instrument, wherein an end of the height or pitch adjustment screw is adjustably protruding into the neck receptacle and wherein said end of the height or pitch adjustment screw is mechanically contacted with a butt of the neck of the instrument that is disposed in said neck receptacle; and,

c. at least one set screw through the body plate, through the body of the instrument via an inner hole of said height or pitch adjustment screw, and into said butt of said neck wherein said at least one set screw holds the butt in the neck receptacle against said end of the height or pitch adjustment screw.

5. The system of claim **4** wherein the body plate is provided on the body, adjacent to the neck receptacle of the instrument.

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