United States Patent [19]

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[54] STRING TENSIONING DEVICE

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[52] **U.S. Cl.** **84/304**

[51] **Int. Cl.** **G10d 3/14**

[58] **Field of Search** 84/304–306, 297

[56] **References Cited**

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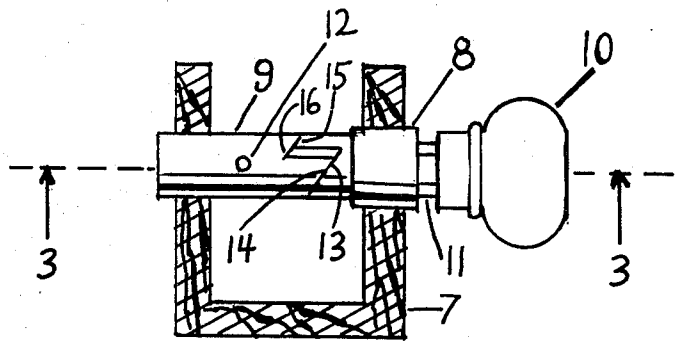
Primary Examiner—Stephen J. Tomsky
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[57] **ABSTRACT**

A string tensioning device is described which selectably provides a coarse turning mode which permits the device to be turned as a whole, and a fine turning mode which provides a rotational and torque reduction between the rotatable section of the device to which the string is attached and a second rotatable section.

Two embodiments of the device are described as applied to the tuning pegs used in stringed musical instruments such as the violin, viola, and cello. In these embodiments both the rotational reduction and the torque reduction provided by the device greatly facilitates the tuning of the string in comparison to the tuning action of the standard tuning peg.

12 Claims, 6 Drawing Figures



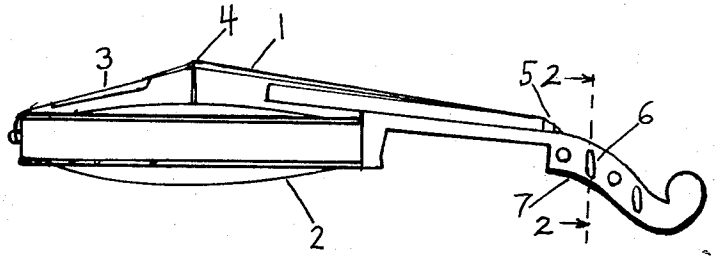


FIG. 1

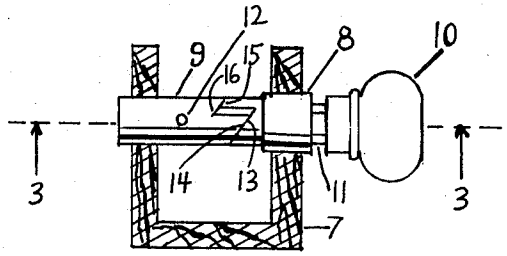


FIG. 2

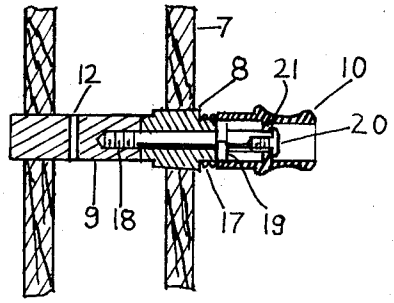


FIG. 3

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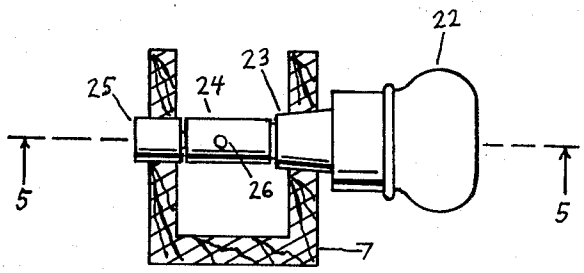


FIG. 4

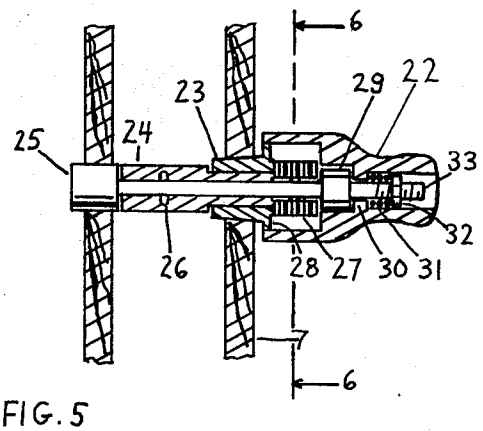


FIG. 5

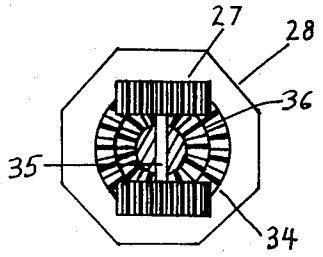


FIG. 6

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STRING TENSIONING DEVICE

BACKGROUND OF THE INVENTION

This invention relates to a string tensioning device, directly applicable to stringed musical instruments such as the violin, viola, and cello, and interchangeable with the usual one piece tuning peg. It overcomes the problems of the usual one piece tuning peg, which requires so much friction between the peg and the peg box to sustain the string tension that fine tuning is very difficult. The difficulty increases as the string tension increases because of the slip-stick nature of static friction and because of the increase in frictional torque necessary to resist the torque exerted by the string tension. When sufficient torque is applied to the knob of the peg to overcome the static friction, the peg usually turns too far, so that a number of attempts must be made in order to have the peg come to rest with the correct string tension. Young students also have difficulty in exerting enough torque to the usual peg to turn it.

Previous attempts to solve the problem have been only partially successful. One method consists of application of a semi-lubricant to the peg in order to reduce static friction. Another consists of a peg with a self-contained adjustable friction bearing which is wedged into the peg box. The adjustment of the friction in the actual bearing helps to overcome variations in friction due to expansion and contraction of the wooden peg and peg box with temperature and humidity, but does not provide the vernier action and mechanical advantage necessary for fine tuning.

SUMMARY OF THE INVENTION

One object of the present invention is to provide a string tensioning device, or tuning peg, substantially interchangeable with the usual tuning peg and having a first mode for initial coarse tuning. In this mode the device is turned as a whole to establish approximately the correct tension in the string, but fine tuning is not attempted so that any friction between the peg and the peg box is satisfactory as long as it can sustain the string tension.

Another object of the invention is to provide the tuning peg with a second mode for easy fine tuning. In this mode a first section of the peg to which the string is attached is rotatable with respect to a second stationary section, which is held in the peg box by friction. Rotation of the knob of the peg produces reduced rotation of said first section with respect to the knob of the peg, thus providing a vernier action and reducing the torque required to turn the peg knob.

Other objects of the invention will be made more apparent by reference to the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a stringed musical instrument,such as the violin, showing the parts of the instrument which sustain the tension of the string.

FIG. 2 is a section through the plane 2—2 of FIG. 1 showing one embodiment of the string tensioning device installed in the peg box of the instrument shown in FIG. 1.

FIG. 3 is a section through the plane 3—3 of FIG. 2 showing the internal construction.

FIG. 4 is a section through the plane 2—2 of FIG. 1 showing an alternate embodiment of the string tensioning device.

FIG. 5 is a section through the plane 5—5 of FIG. 4 showing the internal construction.

FIG. 6 is a section through the plane 6—6 of FIG. 5 omitting the knob and showing details of a differential gear reducer.

Referring to FIG. 1, it will be apparent that string 1, supported by a musical instrument 2, is attached at one end to the tailpiece 3, passes over the bridge 4, and the block 5, and is wound around a peg 6 which is supported in the peg box 7. The string is tuned by rotation of the peg 6 to adjust the tension of the string.

The details of the tensioning device are shown in FIG. 2. A bushing 8 has a tapered outside diameter adapted to fit a tapered hole in the peg box 7, a hexagonal extension 11 on one end, and inclined faces 13 an 15 on the other end. A cylindrical rod 9, loosely fitting at one end into a hole in the peg box 7, has a transverse hole 12 for attaching the string. At the other end inclined faces 14 and 16 slidably contact the faces 13 and 15. A knob 10, axially movable and rotatable, provides either coarse or fine tuning as shown in more detail in FIG. 3.

Referring to FIG. 3, the knob 10 has a hexagonal socket at its left end and a cylindrical recess at the other end separated by a septum 21. In the fine tuning position illustrated, the knob 10 engages a hexagonal section 19 of a screw 18 threaded into the rod 9, but is kept out of engagement from the hexagonal section 11 of bushing 8 by compression spring 17. The knob 10 is retained against the spring pressure by the head of the screw 20, screwed into the shank of the screw 18.

The resulting mechanism allows the screw 18 to be turned by turning the knob 10, thus causing the rod 9 to be moved axially with respect to the stationary bushing 8. The inclined faces 13, 14, 15, and 16 convert the axial motion into rotation of rod 9 thus changing the tension of the string. The mechanical advantage gained by this means makes fine tuning very easy, and it is self locking against rotation due to string tension.

For coarse tuning, the knob 10 is pushed in against the pressure of the spring 17 to engage the hexagonal section 11 of bushing 8. Since the hexagonal section 19 of screw 18 is also engaged, the device turns as a whole in the coarse tuning position of knob 10. This directly adjusts the string tension in a similar fasion to the usual one piece tuning peg.

An alternate embodiment of the invention is shown in FIG. 4. A bushing 23 has a tapered outside diameter, adapted to fit a tapered hole in the peg box 7, a plane face at its left end, a hexagonal flange 28 outside of the peg box 7, and a face gear at its right end. A sleeve 24, having a transverse hole 26 for attachment of the string 1, and rotatably supported on a shaft 25, also has a face gear at its right end. As shown in FIG. 6 face gears 34 and 35 are in contact with spur gears 27, rotatably supported on an axle 35 attached transversely to the shaft 25. The shaft 25 also has a hexagonal section 29 and a threaded section 33 for attachment of a knob 22 by means of a spring 31 bearing against septum 30 and a nut 32. The knob 22 has an inner hexagonal recess engaging the hexagonal section 29 of the shaft 25, and an outer hexagonal recess for engaging the hexagonal flange 28 of the bushing 23.

In the position shown in FIG. 5, the knob 22 engages both hexagonal sections allowing the device to be turned as a whole for coarse tuning. The knob 22 is pulled out against the pressure exerted by the spring 31 for fine tuning. In the fine tuning position the hexagonal flange 28 is disengaged from the knob 22, and rotation of the knob 22 causes the spur gears 27 to rotate against the face gears 34 and 36. Because the face gear 34 is stationary and has more teeth than face gear 36, rotation of the spur gears 27 against the face gears 34 and 36 causes a differential rotation of face gear 36, reducing the rotation of the sleeve 24 with respect to the knob 22 and permitting sleeve 24 to be rotated very easily and smoothly for fine tuning. For example face gears 34 and 36 may have 14 teeth and 12 teeth respectively, while spur gear 27 may have 8 teeth. Since face gears 34 and 36, and spur gear 27 have the same diametral pitch, the gears mesh properly, and provide a rotation of one seventh turn of face gear 36 and sleeve 24 for one turn of knob 22.

This completes the description of the embodiments illustrated herein. However, this invention is not limited to the particular details of construction, materials and processes described, as many equivalents will suggest themselves to those schooled in the art. For example, a spline construction may be used instead of the hexagonal construction used for engaging the knob. In addition, the mechanical advantage necessary for the fine tuning mode may be gained by other means. Nor is this invention limited to the particular application to musical tuning pegs that is illustrated herein, as many other uses may suggest themselves to those skilled in the art. It is accordingly desired that the appended claims be given a broad interpretation commensurate with the scope of the invention within the art.

What I claim is:

1. A string tensioning device comprising:
- a first rotatable section having string attachment means;
- a second rotatable section for rotating said first rotatable section; and
- cam means for reducing the rotation of said first section with respect to the rotation of said second section.

2. A string tensioning device according to claim 1, and further including:
- selectable means for producing the same amount of rotation of said first and second sections.

3. A string tensioning device according to claim 1, wherein said cam means for reducing the rotation of said first section with respect to the rotation of said second section comprises:
- a rotatable shaft having at least a portion of one surface inclined to its axis;
- a stationary bushing with at least a portion of one surface inclined to its axis and in contact with the inclined surface of said shaft; and
- screw means for moving said shaft axially to produce rotation of said shaft.

4. A string tensioning device according to claim 3, and further including:
- selectable means for producing the same amount of rotation of said first and second sections.

5. A string tensioning device according to claim 4, in which:
- said screw means comprises a screw engaged with said first section; and
- a mating flange portion of said screw slideably engaged in a socket portion of said second section;
- whereby rotation of said second section rotates said screw and moves said shaft axially to produce rotation of said shaft.

6. A string tensioning device according to claim 5, in which:
- said selectable means for producing the same amount of rotation of the said first and second sections comprises a slideable socket portion of said second section; and
- a mating flange on said stationary bushing adapted to to engage said slideable socket;
- thus locking the screw means against rotation of said first section with respect to said second section.

7. A string tensioning device according to claim 3, in which:
- said screw means comprises a screw engaged with said first section; and
- a mating flange portion of said screw slideably engaged in a socket portion of said second section;
- whereby rotation of said second section rotates said screw and moves said shaft axially to produce rotation of said shaft.

8. A string tensioning device comprising:
- a first rotatable section having string attachment means;
- a second rotatable section for rotating said first section; and
- differential gear reducer means for reducing the rotation of said first section with respect to the rotation of said second section.

9. A string tensioning device according to claim 8 and further including:
- selectable means for producing either the same or reduced rotation of said first section with respect to the rotation of said second section.

10. A string tensioning device according to claim 8, in which:
- said differential gear reducer means consists of a first face gear on said first section;
- a stationary bushing having a second face gear adjacent said first face gear; and
- means rotatably supported and driven by rotation of said second section for connecting said first and second face gears;
- whereby the rotation of said first section with respect to the rotation of said second section is reduced due to the difference in the number of teeth on said face gears.

11. A string tensioning device according to claim 9, in which:
- said differential gear reducer means consists of a first face gear on said first section;
- a stationary bushing having a second face gear adjacent said first face gear; and
- means rotatably supported and driven by rotation of said second section for connecting said first and second face gears;
- whereby the rotation of said first section with respect to the rotation of said second section is reduced due to the difference in the number of teeth on said face gears.

12. A string tensioning device according to claim 11, in which:

said selectable means comprises a slideable socket portion of said second section; and a mating flange on said stationary bushing adapted to engage said slideable socket;

thus locking the differential gear reducer means against rotation of said first section with respect to said second section.

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