2017

PATENT ATTORNEYS EXAMINATION

PAPER E

Patent Attorney Practice in New Zealand Including Interpretation and Criticism of Patent Specifications

Regulation 158(1)(e)

Duration: 4 hours (plus 10 minutes for reading)

QUESTION

Documents

- Draft patent application for Jemima Hendrix
- Granted NZ patent NZ123456 owned by Beck Vaughan Limited, priority date 24 October 2014, filed 5 March 2015
- Prior art document US 4,203,342 (D1) published 18 February 2008
- Prior art document US 4,308,780 (D2) published 21 November 2005

Facts

Your client is Jemima Hendrix. Jemima runs a business called The Experience Limited, hand-making acoustic and electric guitars.

A particular problem facing makers of stringed instrument is warping of the neck, which affects playability of the instrument. Warping occurs from tensioning the strings, or through the action of temperature and humidity on the wood of the instrument.

To address neck warping, instrument manufacturers insert a straightener (sometimes called a truss rod) in the neck of the instrument. The simplest of these neck straighteners is a single threaded rod anchored at each end on a structure in the neck. Tightening a nut on the threaded rod causes the rod to bow, counteracting the warping. Double truss rods, comprising two rods which can be adjusted relative to one another, allow more precise correction of warping.

Jemima has become increasingly dissatisfied with available straighteners. The stiffness of a guitar neck varies along its length, because of the varying thickness and rigidity of the wood, and available straighteners don't compensate for this. Also, available straighteners tend to be 'set' in a particular configuration, and afterwards can't be changed to deal with variations in warp over time.

Jemima has developed her own neck straightener which she thinks is a big improvement over other straighteners on the market. Jemima's friend Dave Gilmour, who is a trainee patent attorney, has drafted the start of a patent application for Jemima's straightener, and she gives this to you to read.

Jemima tells you that while some of the available straighteners claim to be able to deal with convex and concave warp of the neck, she finds they end up doing neither very well. She thinks that concave warp of the neck relative to the strings, caused by tensioning, is the most significant problem and so her straightener is configured to deal only with that. She tells you that the pattern of the deflection provided by the specific placement of the multiple spacers (relative to the heel of the neck, the neck-body joint, the varying thickness of the neck along its length and the length of the neck) means her neck straightener can accommodate widely varying deformation forces. Also, her design allows the instrument to have a thin neck of increased strength. A thinner neck is desirable from a player's perspective, but will bend more on tensioning than a thicker, heavier neck.

In Jemima's opinion, a key advantage of her neck straightener is that it's customisable. The spacers can be moved to any position along the steel rod 70, and if the warp in the neck changes the straightener can be removed from the instrument and the spacers changed. She isn't aware of any other straighteners that do this.

Jemima wants to use her neck straightener (which she calls 'The Freebird') in all her guitars from now on. She may also sell it separately to other guitar manufacturers and musicians. However, Dave has found granted New Zealand patent NZ123456, and she worries that the owner Beck Vaughan Limited might sue her if she puts her straightener on the market. She doesn't think the patent is valid, because Dave has found two prior art documents that he thinks are pretty close, but Beck Vaughan is quite aggressive and (she says) unscrupulous. For example, NZ123456 describes a test of Beck Vaughan's invention against an E Clapton Corp straightener called 'The Layla', and Jemima is pretty sure 'The Layla' doesn't exist.

As you are finishing up your meeting with Jemima, she tells you that she thinks that sometime in 2014 she remembers Steve Vaughan from Beck Vaughan playing a guitar at a trade show that he told everyone had a 'great new straightener' in it. Everyone in the business goes to these trade shows - in fact, Jemima is going to one next month and wants to demonstrate her new Freebird neck straightener then.

Questions

Provide advice to Jemima on the following:

1.	Would manufacture and sale of Jemima's Freebird straightener infringe patent NZ 123456?	40 marks
2.	What are Jemima's options for challenging the validity of NZ123456, and would she be successful?	40 marks
3.	What might Beck Vaughan do to improve its position?	10 marks
4.	What other issues should Jemima be aware of, and what actions could she take to improve her position?	10 marks

DRAFT PATENT APPLICATION OF JEMIMA HENDRIX

Brief description of the drawings

FIG. 1 is an exploded perspective view of the body and neck assemblies of the solid body electric guitar of this invention.

FIG. 2 is a cross-sectional view of the truss rod assembly of the guitar of FIG. 1, with the truss rod and spacers shown in full view.

FIG. 3 is a schematic view, showing in exaggerated terms the results of the bending forces of the guitar strings and the results of the counteracting bending forces of the truss rod assembly.

FIG. 4 is a fragmentary top plan view of the assembled guitar of this invention, with the truss rod assembly of this invention shown in hidden view.

FIG. 5 is a cross-sectional view of the guitar of FIG. 4 taken along section line 5--5.

FIG. 6 is an exaggerated schematic view of the deflection of the truss rod assembly of the guitar of FIG. 1.

Description of the preferred embodiment

An electric guitar 20 of the present invention is shown in FIG. 1. The guitar 20, shown with strings removed and in exploded view in FIG. 1, has a contoured wooden body 22 in which a number of cavities are formed to receive such elements of hardware as the guitar pickups 24, tone and volume control knobs 25, bridge 27, vibrato unit, etc. The neck 26 is a separable wooden element, commonly composed of two wooden components: a fingerboard 28 and a neck back 30. The neck back 30 includes the head 32 to which the tuning pegs 33 are mounted. The fingerboard 28 may be of a different species of wood than the neck back 30, and has a number of frets 34 positioned to protrude above the fingerboard surface and spaced at precise distances along the fingerboard to make possible the sounding of the notes of a musical scale. Strings 36 extend from the tuning pegs 33 to the bridge 27. The strings 36 are brought into tune by applying tension to them by adjustment of the tuning pegs 33.

The strings, which are under simple tension between the tuning pegs 33 and the bridge 27, describe a straight line. The effect of this string tension on the wooden neck 26 is illustrated in greatly exaggerated form in FIG. 3. The neck will be displaced from the plane of the body 22, with the greatest displacement being observed at a position most distant from the body. At the joint between the neck and the body, where the greater stiffness and weight of the body comes into play, there is little or no displacement of the neck. Yet any curvature of the neck 26 will tend to detract from the ideal even spacing of the strings from the fingerboard 28.

Although a perfectly stiff neck 26 would be desirable, the need for a lightweight instrument, as well as for a narrow neck which allows the player's hand to move easily around it, puts an upper limit on the mass and volume of the neck.

The neck 26 is connected by screws to the body 22, and has interlocking structure formed on the neck 26 and the body 22 which resist shifting of the neck 26 which still permits ready disassembly of the neck 26 from the body 22 for adjustments, service and repair. Such adjustments may be particularly needed during periods of dramatic environmental change, for example during the shift between a dry winter and a moist spring, or between a warm summer and a cool fall and winter. In addition, adjustments may be needed when a player changes gauge of strings.

A close to ideal unbowed neck 26 is achieved in the guitar 20 of this invention, by the provision of a truss rod assembly 62 which is positioned in a contoured recess 64 formed in the neck back 30, and best shown in FIG. 5. The truss rod assembly 62, shown in FIG. 2, has a U-shaped aluminum channel member 66 which is disposed in the recess 64 directly beneath the fingerboard 28. The open side of the channel member 66 faces away from the fingerboard 28, so that the ceiling 68 of the U-channel extends beneath the fingerboard 28.

A threaded stainless steel rod 70 extends through the channel member 66. A square metal block 72 is welded onto the end of the rod 70 at the head end of the fingerboard approximately beneath the start of the fingerboard at the string "nut" 74. The square block 72 is received within the square-channel-like recess 64 in the neck back 30 and thereby prevented from rotating.

The recess 64 holds the square block 72 closely adjacent the ceiling 68 of the channel member 66 at the head end. At the body end, the rod 70 and U-channel member 66 are engaged with an L-shaped plate 69, which plate 69 is received in and can slide along the recess 64. The plate 69 holds the end of the rod in close engagement with the ceiling 68 of the channel 66. The U-channel member has slots 68a to receive the plate 69. The rod 70 extends through the plate 69 and along the neck 26 beneath the fingerboard 28, as best shown in FIG. 5, where a long adjustment nut 76 is threaded onto the rod.

Two spacers 80, 82 are placed along the rod 70 and are positioned within the channel member 66. Each spacer is comprised of a cylindrical sleeve 84 through which the rod extends, and a bar stock member 86 which extends within the channel 66 on the ceiling

68 and against which the spacer contacts. The spacers 80, 82 serve to space the rod 70 from the ceiling 68 of the channel member 66, and to prevent sideways flexure of the rod 70. The adjustment nut 76 when tightened holds the ends of the rod 70 in close engagement to the ceiling 68 of the channel member 66, while the spacers 80, 82 position portions of the rod 70 away from the ceiling. The recess 64 in the neck back 30 is contoured to provide space for the spacers 80, 82 and the rod 70 as it protrudes beyond the channel member 66. In particular, the spacers 80, 82 do not contact the base of the recess 64 at any stage.

To enable the channel member 66 to flex without twisting, at least one wall of the channel is notched with square shaped cut outs 67.

As shown in FIG. 5, three distinct regions are defined along the truss rod assembly 62. A first region A extends between the plate 69 and the first spacer 80. A second region B extends between the first spacer 80 and the second spacer 82. A third region C extends between the second spacer 82 and the square block 72 beneath the instrument "nut" 74. Because of the stiffness characteristics and geometry of the neck, the deflection of the neck 26 caused by the strings 36 tends to increase continuously from the body connection of the neck to the head 32, as illustrated in FIG. 3. The counteracting forces of the truss rod assembly 62 are disposed to address the conditions in each of the regions A, B, and C, as shown in FIG. 6. In the schematic view of FIG. 6, the uncorrected curve of the neck is designated 92, and the neck joint region is indicated by the width 90.

As the adjustment nut 74 is turned and tightened, the plate 69 will be brought closer to the metal block 72, forcing the ends of the channel member 66 closer together. As the nut 74 is advanced, the rod 70 is placed in tension, while the channel member 66 is placed in compression. The untightened disposition of the rod 70 is in a shallow curve concave toward the fingerboard 28, as shown in FIG. 5. This concavity is brought about because the spacers 80, 82 push the rod 70 away from the ceiling 68 of the channel member 66 by contacting on the bar stock members 86, while the ends of the rod are held against the floor. Tightening of the adjustment nut 74 tends to straighten out the curved rod. Yet because the second section B between the two spacers is spaced from the channel member ceiling 68 by the spacers, it will tend to remain undistorted while the ends of the channel member 66 are brought to the same level as section B. As shown in FIG. 6, the result is that the maximum deflection occurs in region C, precisely where the maximum distortion of the neck 26 is experienced. The end of the channel member 66 adjacent the plate 69 on the body side of the neck 26 will also be flexed and tend toward the same level as the elevated second region B. Yet because the neck joint and neck in the first region A is particularly stiff, the truss rod assembly 62 is substantially held flat along the first region A. The second region B will generally remain flat between the first spacer 80 and the second spacer 82, although it will not be in the same plane as the first region A. In region C, the assembly 62 curves downward from the second spacer to a maximum at the metal block 72 beneath the string "nut" 74.

The lengths of the regions A, B, C may vary depending on the particular neck design with which they are employed, but in general the length of the first region A will be less than the length of the third region C, and the length of the second region B will be less than the length of the first region A.

Draft Patent Application
of Jemima Hendrix

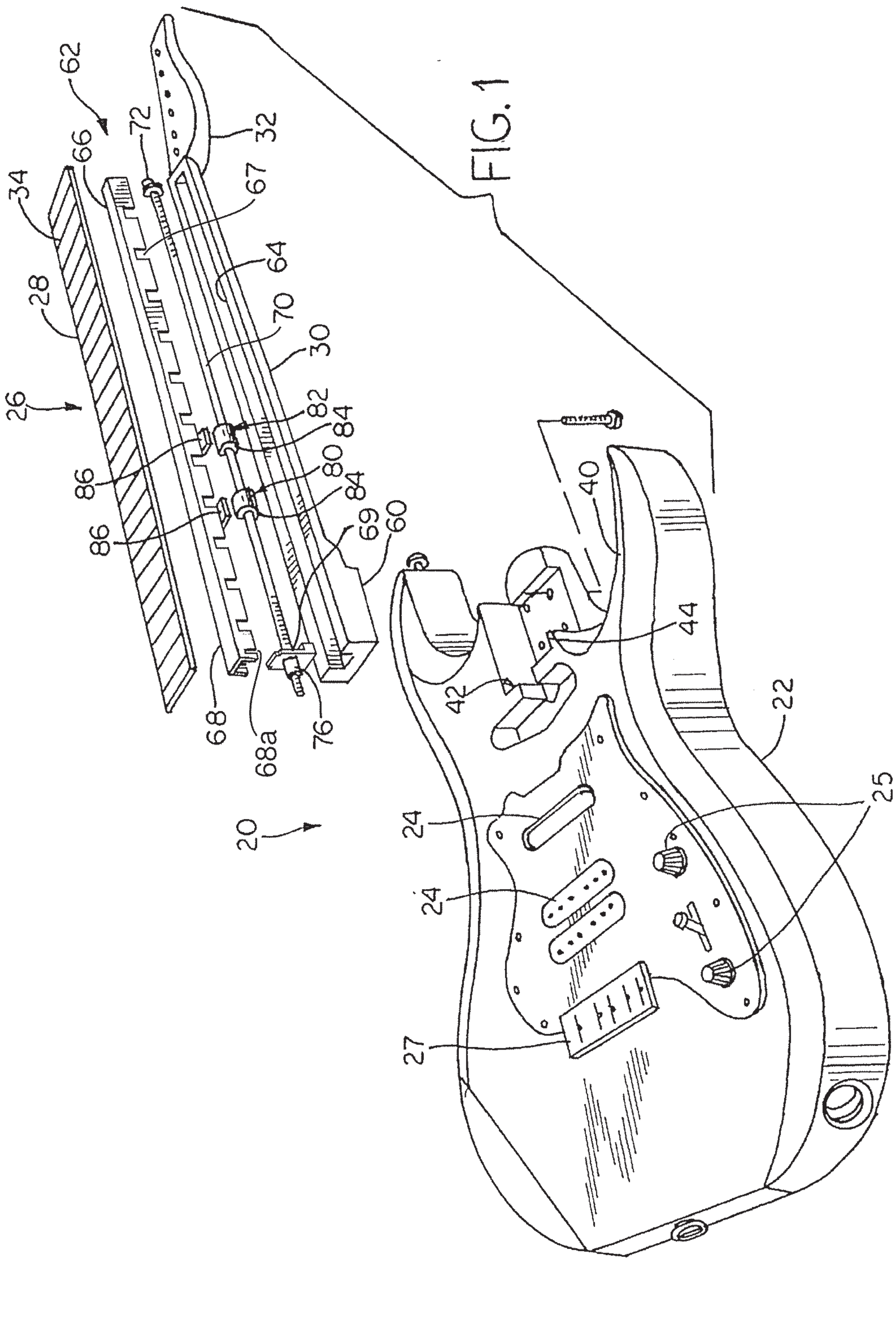

FIG. 1

Draft Patent Application
of Jemima Hendrix

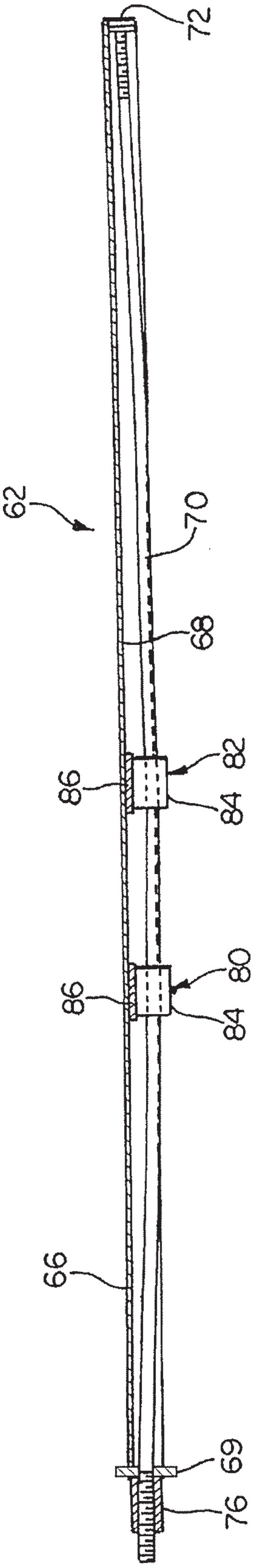

FIG. 2

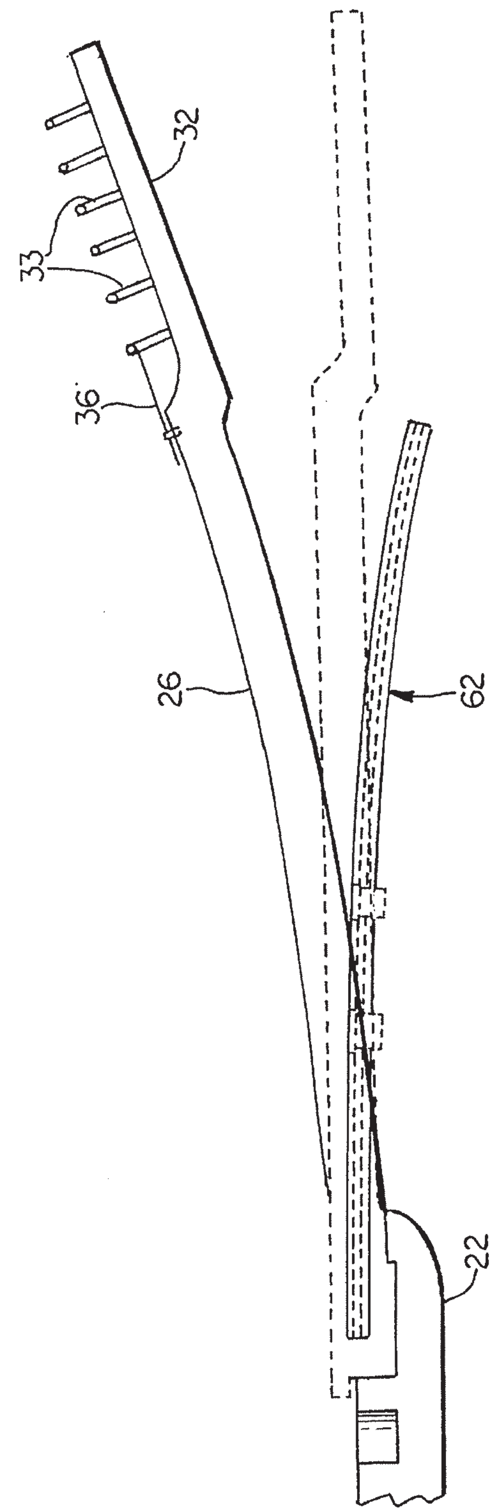

FIG. 3

Draft Patent Application
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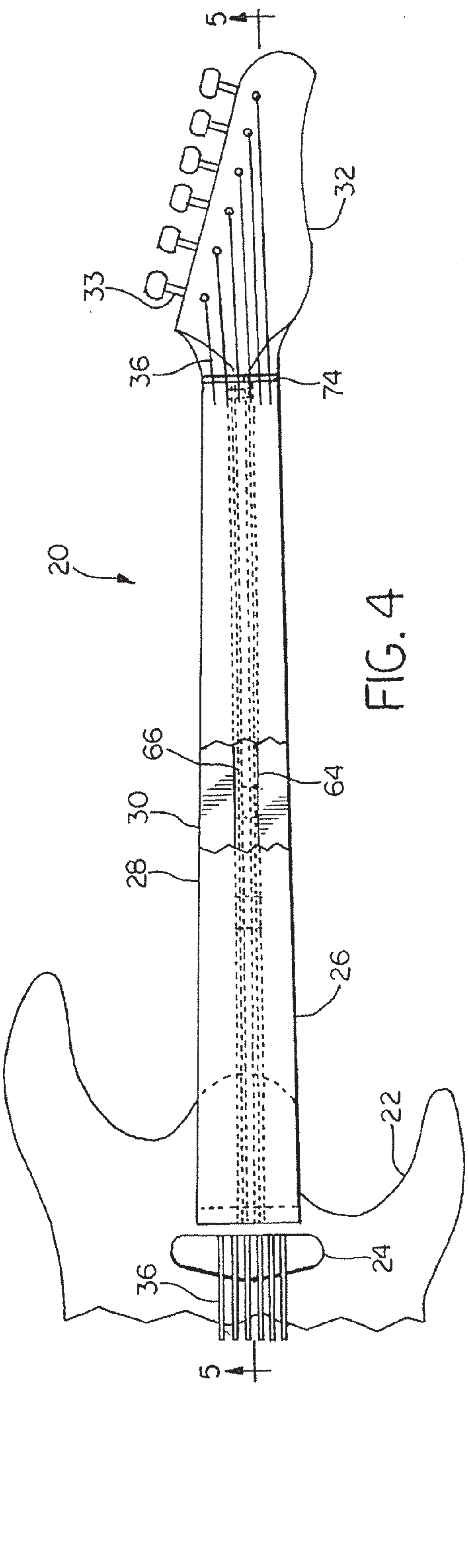


FIG. 4

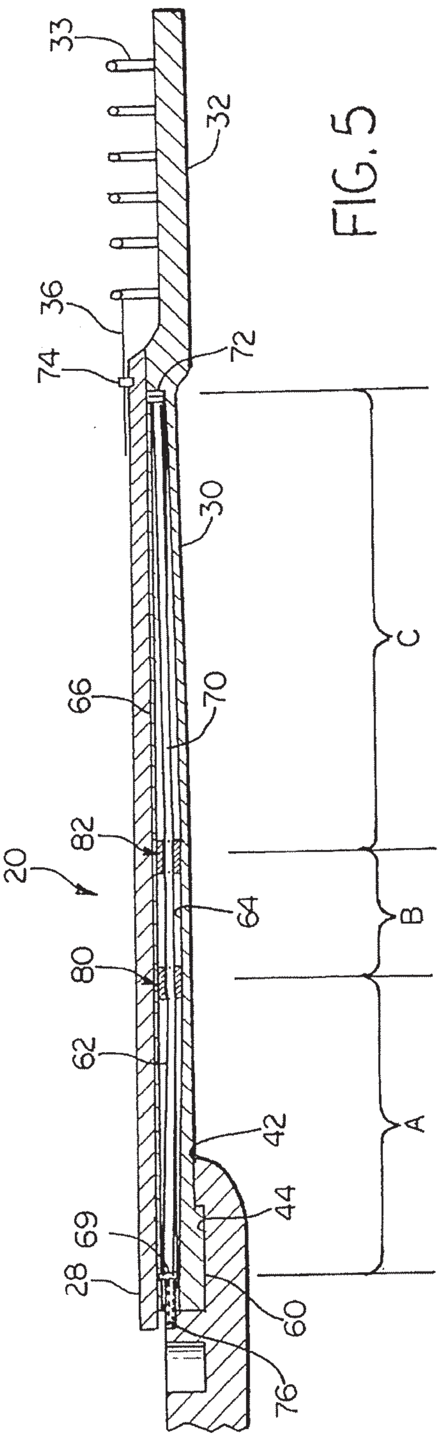


FIG. 5

Draft Patent Application
of Jemima Hendrix

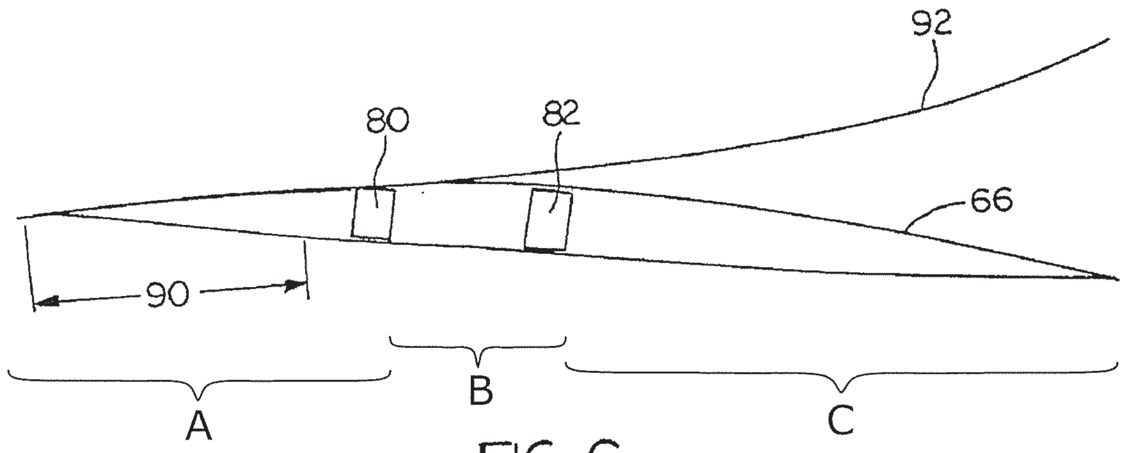


FIG. 6

NZ 123456

NECK STRAIGHTENER FOR STRINGED INSTRUMENT

FIELD OF THE INVENTION

The present invention relates to a straightener to be used in a neck part of a stringed instrument such as a guitar and, more particularly, a straightener formed by two elongate members in a parallel arrangement.

BACKGROUND

The strings of a stringed instrument such as a guitar extend between a bridge provided on a body and pegs provided on a head at the end of a neck part of the instrument.

The wooden guitar neck is subject to twisting or bending towards the body. This bending results from the high levels of tension applied to the metal strings which extend from the pegs fixed to the head at the far end of the neck to the bridge located at the far end of the body. The strings tend to cause the wood of the neck to bend about the neck-body joint, impairing playability and intonation.

The neck part tends to be warped into a concave form by the tension force of the strings relative to the strings, thereby causing an upward warp of the head end of the guitar neck.

The neck part of a stringed instrument may also warp because of the type of wood material forming the neck part and drying thereof, thereby causing a downward or convex warp.

In the case of upward warp, the performer may experience difficulty in fully depressing the strings, or the strings may be depressed so much in being fretted that the pitch of the string is distorted by the excessive extension of the string. In the case of downward warp, the strings come into contact with the frets and the sounding of the strings will be deadened, or the strings may "buzz" against the fingerboard. For this reason, stringed instruments are conventionally provided with straighteners in their neck parts to straighten the neck parts, which will be otherwise warped.

The conventional response to neck bending is to insert a metal truss rod into a channel in the neck, and to tighten the rod to counteract the bending. This simple truss rod is not a complete answer however, because the counteracting forces of the simple truss rod do not exactly balance the bending imposed by the strings. The bow of the wood neck due to temperature and humidity varies with the seasons. In addition, it varies with different string gauges and tunings. Further, this type of straightener can cause a problem in that it is necessary to form a curved groove in the neck part to accommodate the straightener, and the straightening force is weak.

In stringed instruments with a large number of strings having stronger tension, such as an electric guitar, a straightener comprising two rod members assembled in parallel is used. A prior art straightener using two rod members is shown in FIGS 1 and 2.

The prior art straightener two separate rod members 7 and 8 mounted in a mounting plate 6. The straightener is advantageous in that one of the two rod members can be curved in a direction opposite to the direction of warp of the neck part 1, by increasing and decreasing the length of the second rod member 7 compared to the first rod member 8 using adjusting means 4. The repulsive force produced by such curving is used as a straightening force to straighten the warp of the neck part 1 and therefore the rigidity of the whole straightener can be increased and the repulsive force can be increased as well. The repulsive force is obtained by curving one of the two rod members 7 and 8 in the direction of arrow 2 or 3, and therefore the stress concentration point 5 which acts on the neck part 1 is the centre of the curve of the curved rod member.

However, in the case of a concave warp of the neck part relative to the strings due to the tension of the strings (FIG 2), the stress concentration point 5, that is, the centre of straightening force, is located at a point deviated from the centre of warp of the neck part toward the head end and therefore the neck part cannot be accurately straightened.

In the case of a convex warp of the neck part relative to the strings (FIG 1), though it is generally difficult to locate the centre of warp it is generally assumed to be around the centre of the straight portion 1a of the neck part 1, and coincides with the centre of straightening by the straightener in most cases. However, the centre of warp may deviate toward the head end of the neck part. In this case, the centre position of warp in the convex warp may greatly differ from that in the concave warp.

Accordingly, there is still a problem that, if the centre of convex warp of the neck part substantially differs from the centre or concentration point of a straightening force of the straightener, accurate straightening cannot be carried out.

A further disadvantage of the prior art straightener is that the requirement to mount the two rods 7 and 8 separately in the mounting plate 6 makes the device complex to use and assemble.

An object of the present invention is to provide a neck straightener for a stringed instrument to be used to straighten concave and convex warp of the neck part of the stringed instrument by concentrating a stress at a center of warp of the neck part.

Another object of the present invention is to provide a neck straightener for a stringed instrument with a stress reducing feature to prevent deformation of a reinforcing member.

SUMMARY OF THE INVENTION

According to one aspect of the present invention, there is provided a stringed instrument having a neck straightener for preventing or reducing warp of a neck part of a stringed instrument, comprising first and second elongate members connected in parallel with each other, adjusting means to increase and decrease the length of said second member with reference to said first member, and at least one pushing block provided on said second member and having a pushing surface for pushing against said first member at a position intermediate the ends thereof, the first member being partly cutaway in the region of the pushing block.

With such an arrangement, the pushing block can be arranged to push the first member in the region of the centre of warp of the neck part of the stringed instrument thereby producing a stress concentration point to straighten the neck part in this region.

In a preferred embodiment, the first member has a U-shaped section. The second member is then preferably accommodated within the first member.

In a preferred embodiment, the edge of the partly cutaway region is continuous and arcuate.

BRIEF DESCRIPTION OF THE DRAWINGS

Certain preferred embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Fig. 1 shows a schematic side view illustrating the operation of a prior art straightener to counteract downward or convex warp.

Fig. 2 shows a schematic side view illustrating the operation of a prior art straightener to counteract upward or concave warp.

Fig. 3 shows a disassembled perspective view of the straightener according to the present invention;

Fig. 4 shows a side view of the straightener;

Fig. 5 shows a perspective view of a guitar incorporating the straightener;

Fig. 6 shows a vertical sectional side view of the neck part of the guitar;

Fig. 7 shows a schematic side view of the straightener according to the present invention when the neck part has concave warp;

Fig. 8 shows a schematic side view of the neck part with a convex warp;

Fig. 9 shows a side view of another embodiment of the straightener;

Fig. 10 shows a bottom view of a part of the straightener;

Fig. 11 shows a side view of the part of the straightener shown in Fig. 10.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

As shown in FIG 3, the straightener comprises first and second elongate members accommodated in an elongate groove 52 of the neck part 51 as shown in FIGS 5 and 6. A finger plate 53 is bonded over the groove 52 to close it.

The first elongate member is a resilient reinforcing member 10 with high rigidity which is located adjacent to the finger plate 53 and comes in contact with the finger plate 53 which defines the ceiling of the groove 52. The second elongate member is a resilient actuating rod 20 with high rigidity which is assembled in parallel with the reinforcing member 10 and comes in contact with the bottom 521 of the groove 52. The resilient actuating rod 20 is provided at its end part with means 30 for adjusting the length of the actuating rod 20, and is also provided with a pushing block 40 which is located corresponding to the centre of warp of the neck part 51.

In this embodiment, the reinforcing member 10 is made of a steel channel member having a U-shaped cross section, and the actuating rod 20 is made of a steel rod.

The reinforcing member 10 and the actuating rod 20 are assembled in parallel so as to lightly contact each other and are firmly jointed together at their extreme ends 11 and 21 with coupling means such as, for example, a weld or a rivet. The other end 12 of the reinforcing member 10 is fixed to the support member 31 of the threaded sleeve 30. The threaded sleeve 30 has an axial threaded hole 32 and is rotatably supported by the support member 31, the support member 31 being fixed at the bottom 521 of the groove 52 provided in a stringed instrument such as, for example, a guitar 50, as shown in FIG 5.

The threaded sleeve 30 receives the end part of the actuating rod 20. The threaded sleeve 30 is meshed with a threaded part 23 which is formed at the end part of the actuating rod 20.

The threaded sleeve 30 is provided with, for example, a hexagonal wrench hole 33 and may be rotated clockwise and counterclockwise by engaging a wrench bar in this hexagonal wrench hole and rotating the wrench bar to increase or decrease the length of the actuating rod 20 with reference to the reinforcing member 10. The wrench hole 33 is disposed in an empty space 11 formed in the neck part 51 of the guitar and exposed so as to permit external operation.

The pushing block 40 is arranged corresponding to the centre of warp in the case of concave warp of the neck part 51, that is, at a position deviated from the centre of the neck part 51 toward the heel part 512, and has a pushing-up surface 41 which comes into contact with the reinforcing member 10.

The pushing block 40 can be further provided with a pushing-down surface 42 which comes into contact with the bottom 521 of the groove 52. In this case, a precondition is that the centre of warp in the case of convex warp of the neck part 51 is located at a position deviated from the centre of the neck part 51 towards the heel part 512.

When the centre of convex warp of the neck part 51 is located at a position deviated from the centre of the neck part toward the head end, there is a considerable distance between the centre of concave warp and the centre of convex warp of the neck part 51. It is then preferable to provide a second pushing block 40' on the actuating rod in addition to the pushing block 40, the second pushing block 40' being arranged at a position which is deemed as the centre of convex warp and having a pushing-down surface 42’ (see FIG 9) which comes in contact with the bottom 521 of the groove.

When two pushing blocks 40 and 40' are arranged in parallel on the actuating rod 20, the pushing-down surface 42 of the first pushing block 40 is unnecessary and a pushing-up surface need not be formed on the second pushing block 40'.

The reinforcing member 10 is provided with a partly cutaway part, which is formed with a continuously arc-shaped edge, on both of its side walls, and the pushing block 40 or the pushing blocks 40 and 40' are arranged in this partly cutaway part 13.

As shown in FIGS 3 and 10 a hard block 60 is installed in the reinforcing member 10 between the side wall of the reinforcing member 10 and the actuating rod 20 so as to maintain a specified clearance between the actuating rod 20 and the side wall of the reinforcing member 10, whereby the actuating rod 20 is prevented from being deformed laterally and its axis is kept straight.

When the neck part 51 is warped concavely as shown with a broken line in FIG 7, the threaded sleeve 30 is rotated to decrease the length of the actuating rod 20 with reference to the reinforcing member 10. The end 11 of the reinforcing member 10 is pulled a distance equal to the decrease in the length of the actuating rod 20 in a direction opposite to the warping direction of the neck part 51, in order to reshape the neck part 51 to be straight. The pushing block 40 can form a stress concentration point when the straightener is accommodated in the neck part 51. A strong straightening force is applied to the neck part 51 at the position where the pushing block 40 is arranged, and is concentrated onto the pushing-up surface 41 of the pushing block 40. The pushing-up surface 41 of this pushing block 40 concentrates the stress to the reinforcing member 10, and the reinforcing member 10 applies a strong straightening force to the centre of warp of the neck part 51. Therefore the central part of concave warp of the neck part 51 where tension is most concentrated is straightened by a strong force. In the case where the neck part 51 is warped convexly in reference to the strings 54 as shown with the broken line in FIG 8, by increasing the length of the actuating rod 20 in reference to the reinforcing member 10, the extreme end 11 of the reinforcing member 10 is pushed up in a direction opposite to the warp of the neck part 51 to produce a straightening force. Therefore, when the straightener is installed in the neck part 51, it can be reshaped to be straight by a repulsive force thus obtained.

In this case, the pushing block 40 comes in contact with the bottom of the groove 52 and forms a stress concentration point and therefore, when only one pushing block 40 is provided as shown in FIG. 4, a depressing force in a direction opposite to the centre of warp in the case of concave warp is strongly applied to the bottom 521 of the groove 52 by the pushing-block 40 whereby the neck part 51 is reshaped to be straight.

The pushing block 40 is arranged at the expected position of the centre of warp of the neck part 51, for example, around the border between the heel part 512 and the straight part 513 of the neck part 51 in upward warp (when the neck part 51 is warped concavely relative to the strings 54) and at a position determined in view of the specific conditions of the neck part 51 in case of downward warp (when that the neck part 51 is warped convexly relative to the strings 54).

The straightener directly pushes the centre of warp of the neck part 51 to accurately straighten the warp of the neck part 51. The warp of the neck part 51 can therefore be exactly straightened.

As shown in FIG 4, only one pushing block 40 may be provided, if the centre of convex warp of the neck part 51 is not far from the centre of concave warp. However, as described above, there are various causes of convex warp of the neck part 51 and therefore the centre of concave warp may be some way away from the centre of convex warp in some cases.

In such a case, as shown in FIG 9, it is preferable to provide two pushing blocks 40 and 40' on the actuating rod 20, one 40 for the concave warp and the other 40' for the convex warp. When two pushing blocks 40 and 40' are arranged in parallel so that these pushing blocks act in response to concave warp and convex warp respectively, the stress concentration point differs with the type of warp.

In this case the pushing block 40 for concave warp is arranged at a position around the border between the heel part 512 and the straight part 513, and only the pushing-up surface 41 is provided on the pushing block 40, while the pushing block 40' is arranged at a position corresponding to the centre of convex warp expected as described above and only the pushing-down surface 42 is provided on the pushing block 40'.

The pushing-down surface 42 of the pushing block 40 need not be provided if the centre of convex warp of the neck part 51 corresponds to the centre of the neck part 51. This is because the centre of curve due to the increase of length of the actuating rod 20 is expected to approximately correspond to the centre of the neck part 51, and therefore the centre of curve of the actuating rod 20 can be used directly as the stress concentration point for straightening.

The pushing block 40 and the second pushing block 40' serve to concentrate the depressing force onto the neck part 51 and therefore a repulsive force of the pushing blocks 40 and/or 40' is concentrated onto the reinforcing member 10, and a part of the reinforcing member 10 corresponding to the positions of the pushing blocks 40 and/or 40' may be bent. However, this repulsive force is dispersedly absorbed by the arc shaped edge 131 which forms the cutaway part 13 of the reinforcing member 10. A stress or a repulsive force to be concentrated onto one point of the reinforcing member 10 is dispersedly applied to the arc-shaped edge 131 to prevent the reinforcing member 10 from buckling.

The reinforcing member 10 has a partly cutaway part 13 of such a length as to include the pushing block 40 as shown in FIGS 9 and 11, and the edge of the partly cutaway part 13 is formed as a continuous arc-shaped edge 131.

If the second pushing block 40' is used simultaneously, the partly cutaway part 13 is made such a length as to include both the pushing block 40 and the second pushing block 40'.

The position of the partly cutaway part 13 is determined in accordance with the position of the pushing block 40 or the positions of two pushing blocks 40 and 40'.The actuating rod 20 may tend to be deformed in a direction lateral to the axial line by a strong depressing force while the pushing blocks 40 and 40' are applying a depressing force to the neck part 51. Such deformation is eliminated by support means in the form of the hard block 60 serving as a separator. The hard block 60 keeps the actuating rod 20 in lateral alignment with the reinforcing member 10. In the illustrated embodiment, a pair of axially spaced hard blocks 60 are provided.

The straightener is usually such that the opening side of the reinforcing member 10 is made to contact with the bottom 521 of the groove 52 and accommodated in the groove 52 as shown in FIGS 5 and 6. In the case that the neck part 51 is downwardly warped from the initial position by the nature of wood material, the reinforcing member 10 can be accommodated in the groove 52 with its opening facing up so that the opening of the groove 52 and the opening of the reinforcing member 10 are facing in the same direction. If so, it is advantageous for the reinforcing member 10 to wholly contact the bottom 521 of the groove 52; the straightening effect of the downward warp will then be large.

The straightener of the invention has been compared with the ‘Layla’ prior art double truss rod manufactured by E Clapton Corporation. The invention showed a significantly better straightening performance and usability, resulting in better playability.

It should be noted that although the body-neck joint of this invention has been illustrated on an acoustic guitar, it may also be employed on other body styles. In addition, the truss rod assembly of this invention could be used in semi-acoustic and solid body electric guitar guitars, and basses.

It is understood that the invention is not limited to the particular construction and arrangement of parts herein illustrated and described, but embraces such modified forms thereof as come within the scope of the following claims.

CLAIMS

1. A stringed instrument having a neck straightener for preventing or reducing concave or convex warp of a neck part, comprising:

   first and second elongate members directly connected in parallel with each other,

   adjusting means to increase and decrease the length of said second member with reference to said first member,

   and at least one pushing block provided on said second member and having a pushing surface for pushing against said first member at a position intermediate the ends thereof.

2. A stringed instrument as claimed in claim 1, wherein the first member is partly cutaway in the region of the pushing block.

3. A stringed instrument as claimed in claim 1 or 2, wherein said pushing block has a second pushing surface located opposite the first pushing surface for pushing against the neck part of the stringed instrument.

4. A stringed instrument as claimed in claim 1 or 2, wherein two pushing blocks are arranged on said second member, one of said pushing blocks having said pushing surface for pushing against said first member, and the other pushing block having a pushing surface which faces away from the first member.

5. A stringed instrument as claimed in any preceding claim, wherein support means is provided on said first member to keep said second member in lateral alignment with said first member.

6. A stringed instrument as claimed in claim 5, wherein said first member has a U-shaped section and said second member is disposed in the channel of the U, and wherein said support means is a block disposed in said channel between the first and second members.

7. A stringed instrument as claimed in any preceding claims, wherein the end portion of said first member and said second member are spot-welded.

8. A stringed instrument having a neck straightener substantially as herein described with reference to the accompanying drawings.

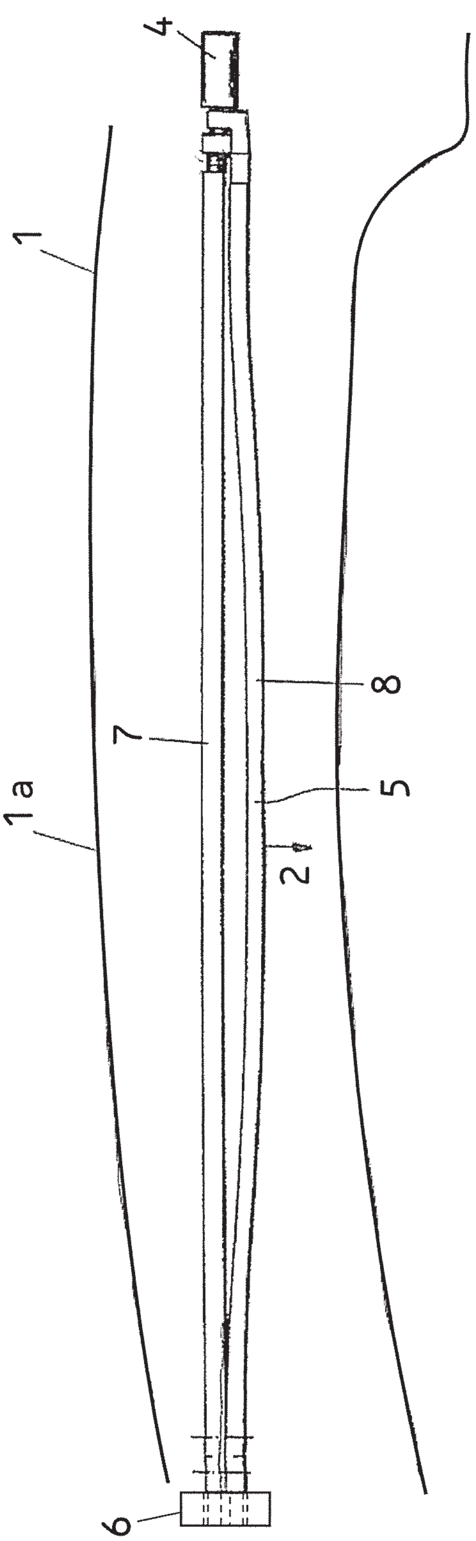


FIG. 1 (Prior Art)

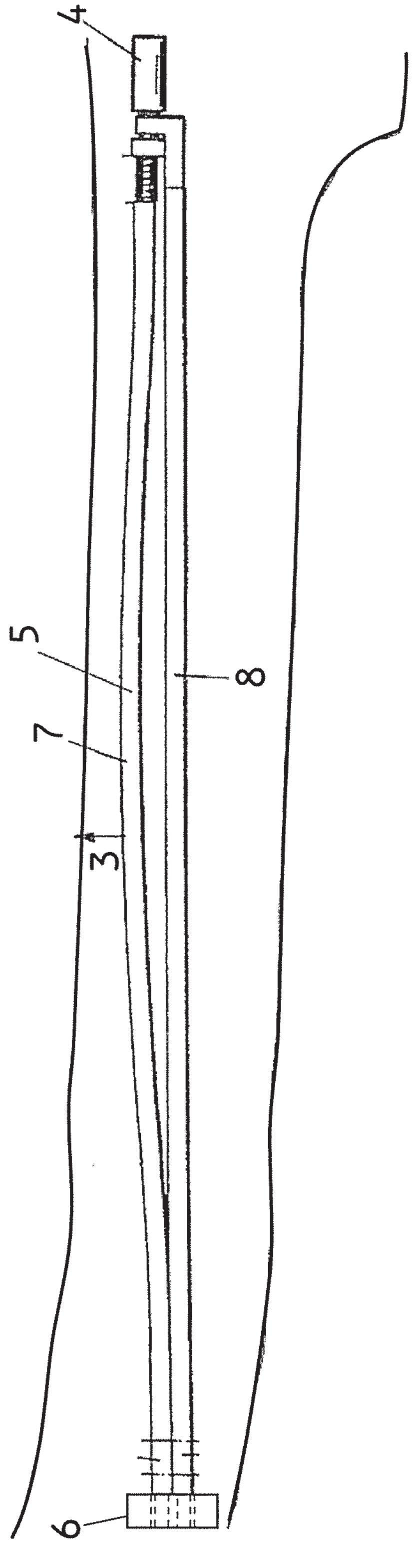


FIG. 2 (Prior Art)

NZ 123456

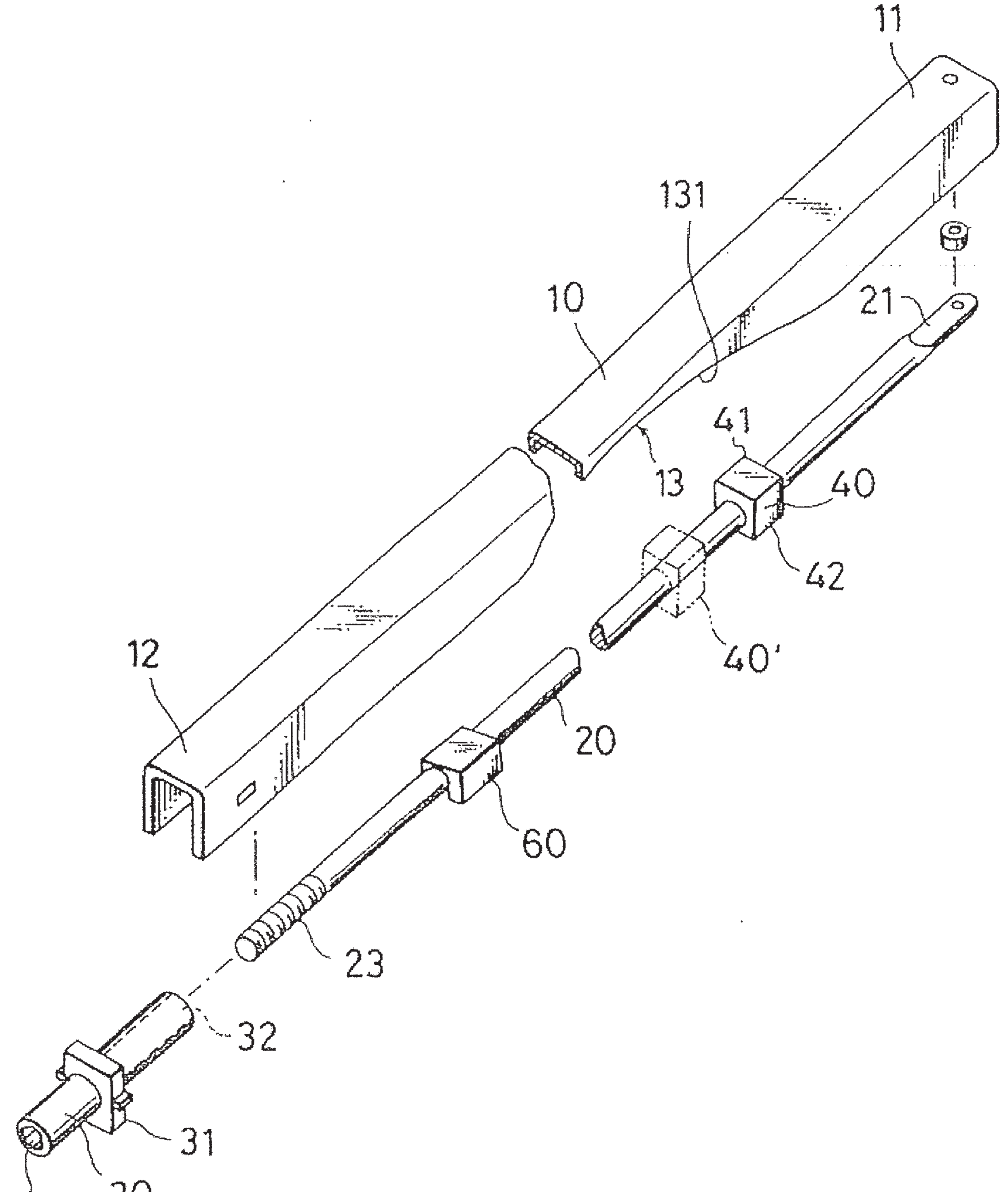


FIG. 3

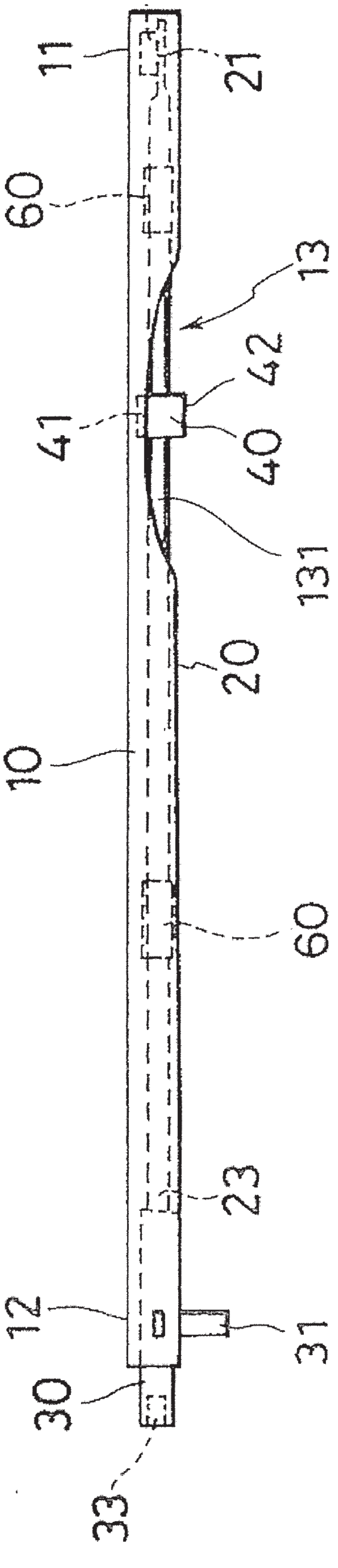


FIG. 4

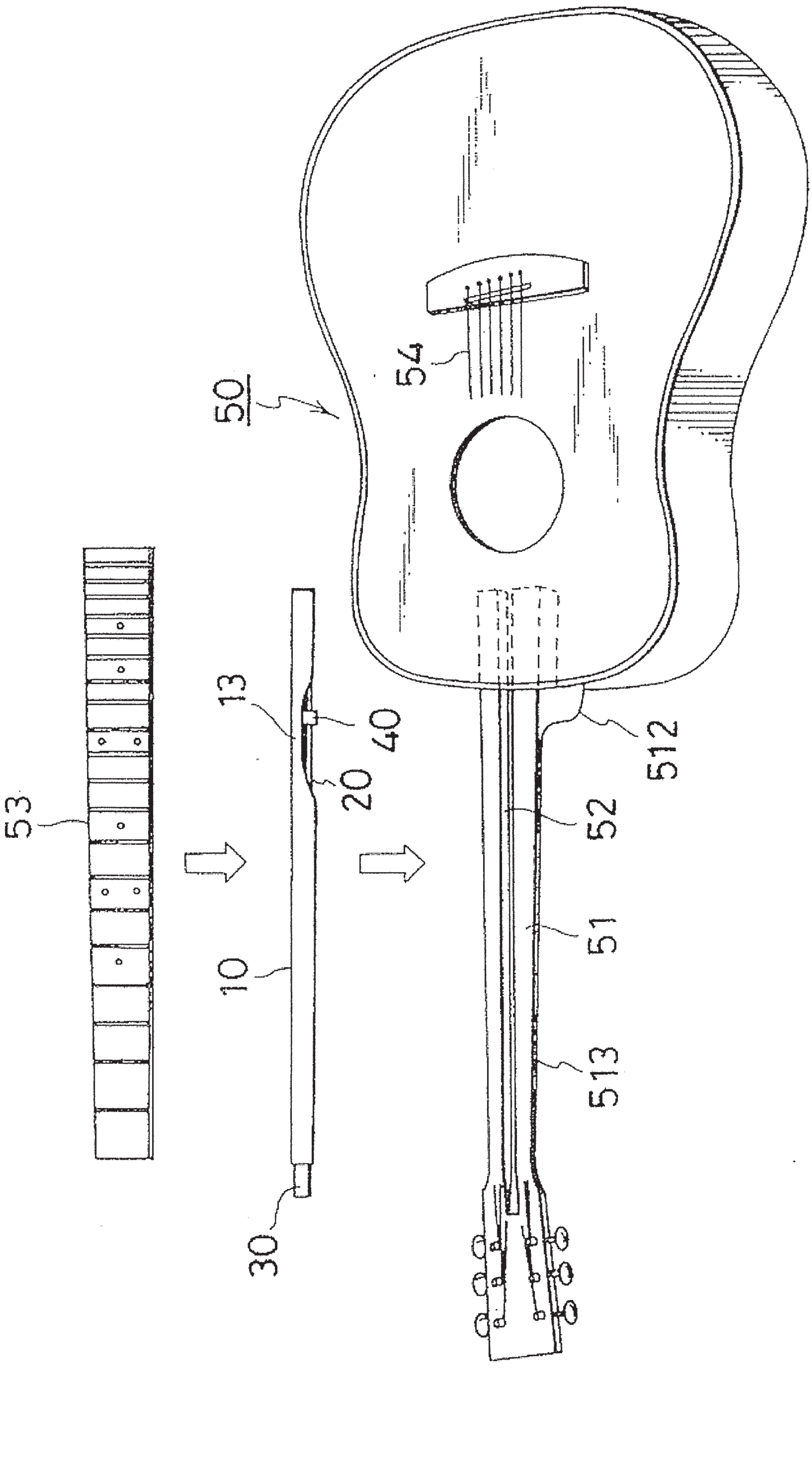


FIG. 5

NZ 123456

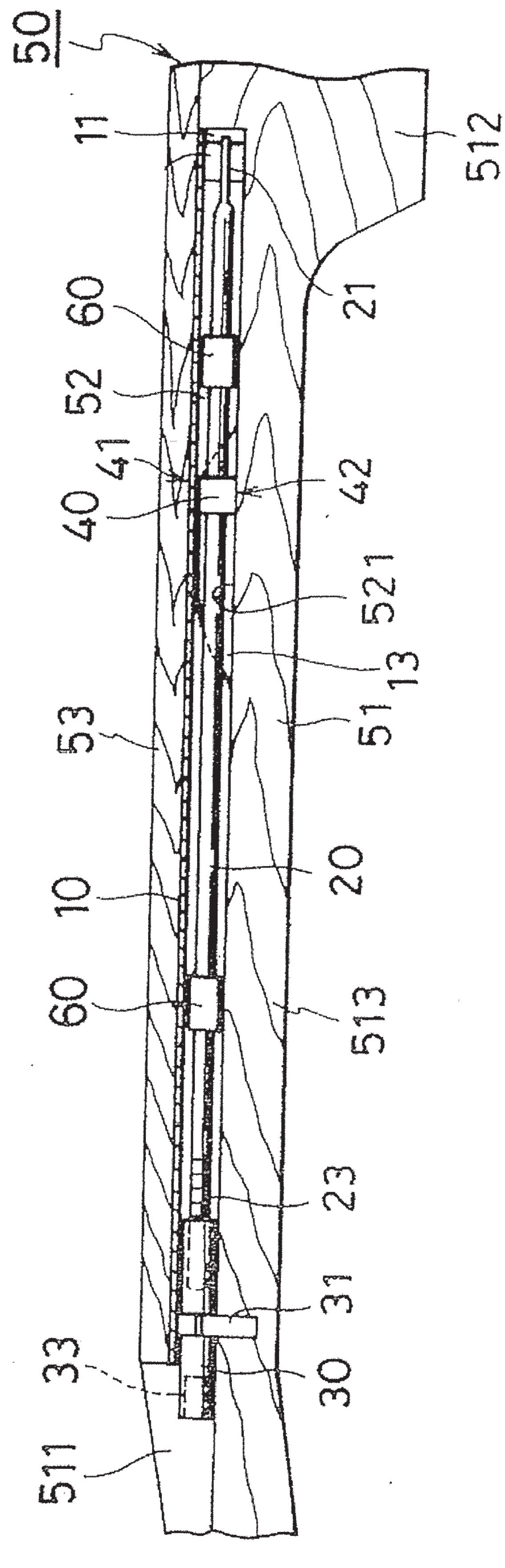


FIG. 6

NZ 123456

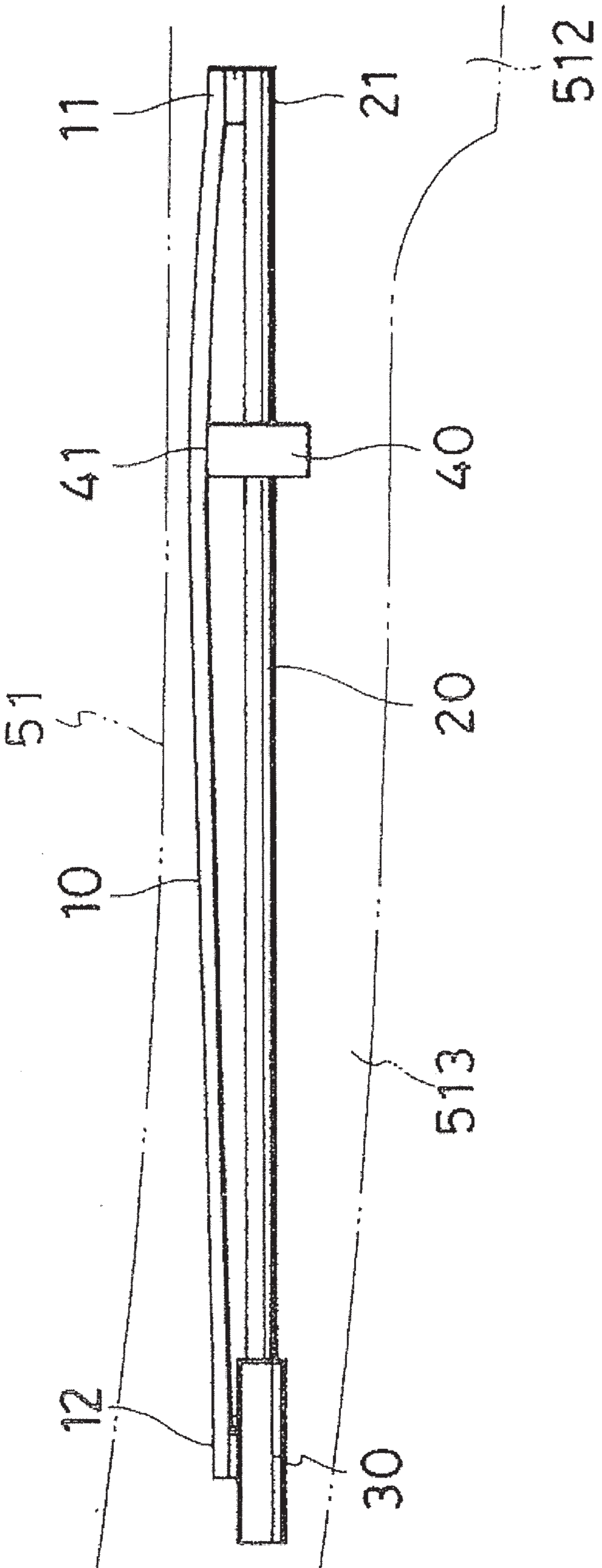


FIG. 7

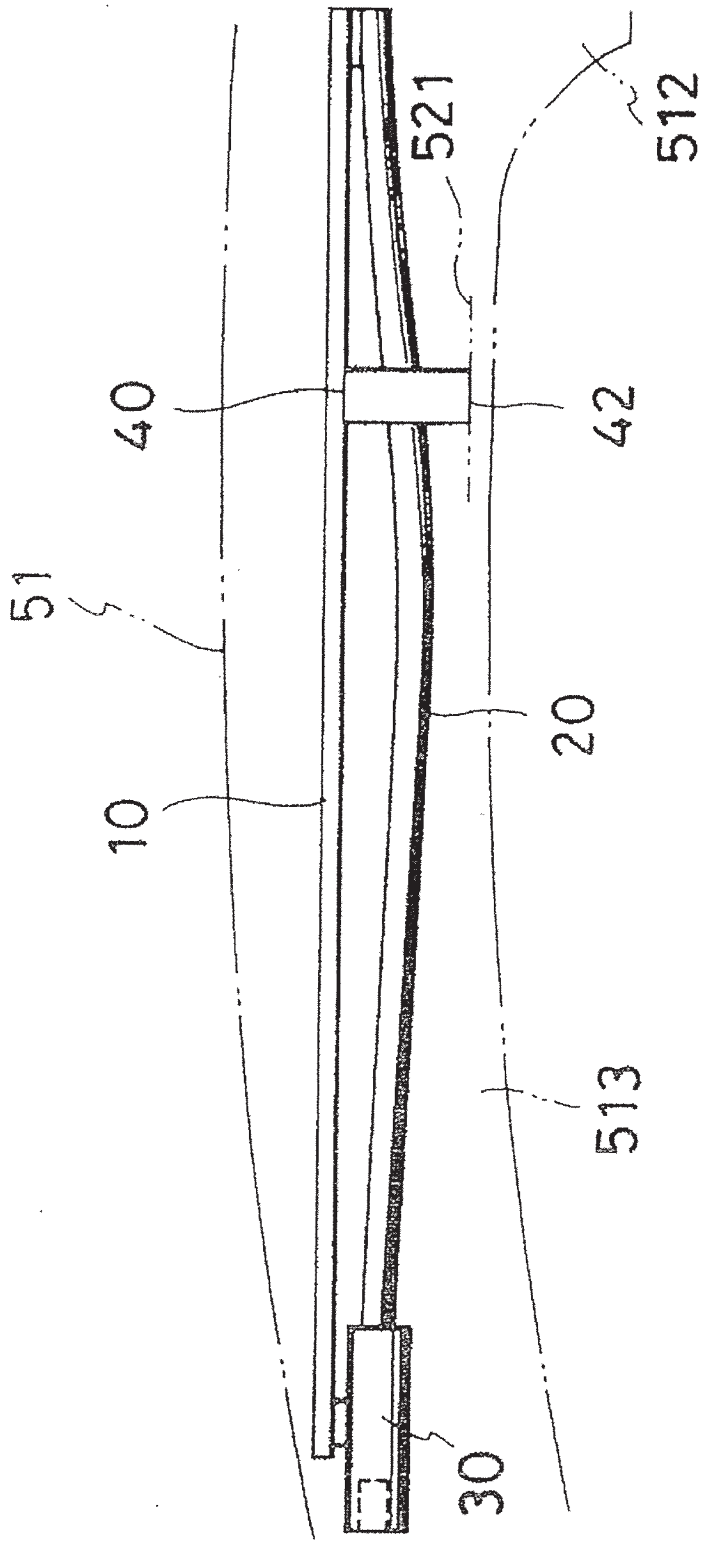


FIG. 8

NZ 123456

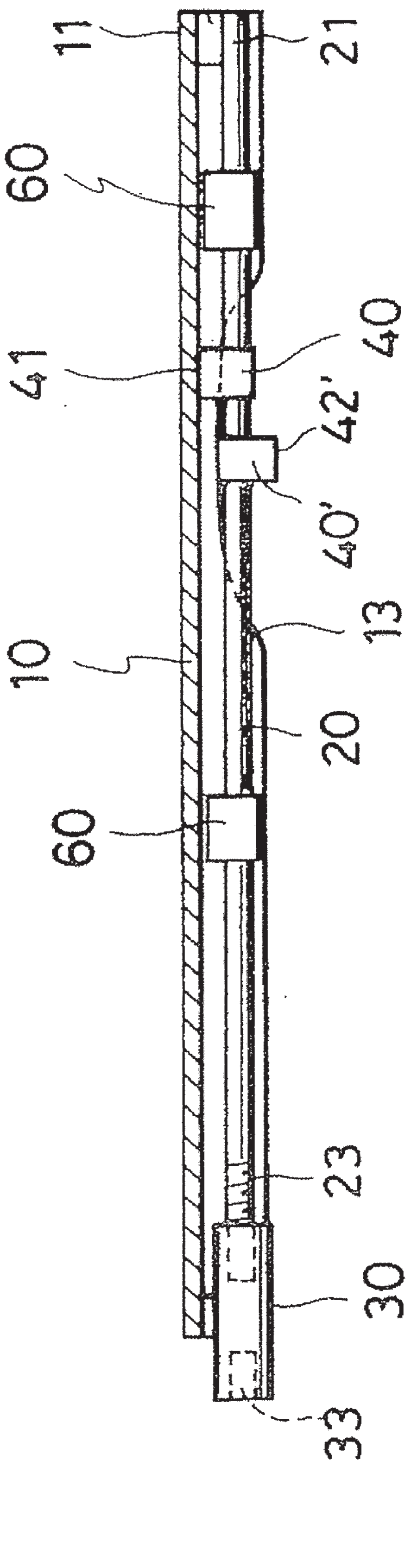
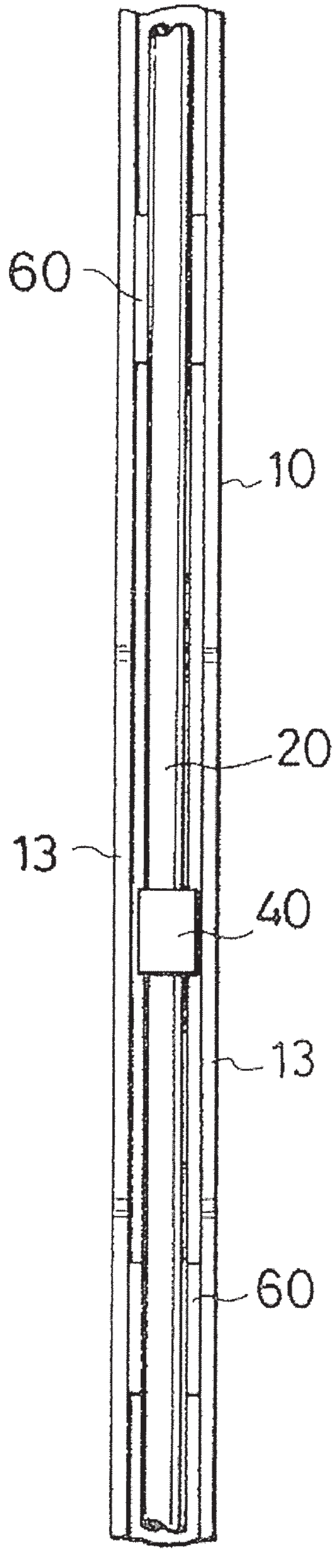


FIG. 9

NZ 123456

FIG. 10



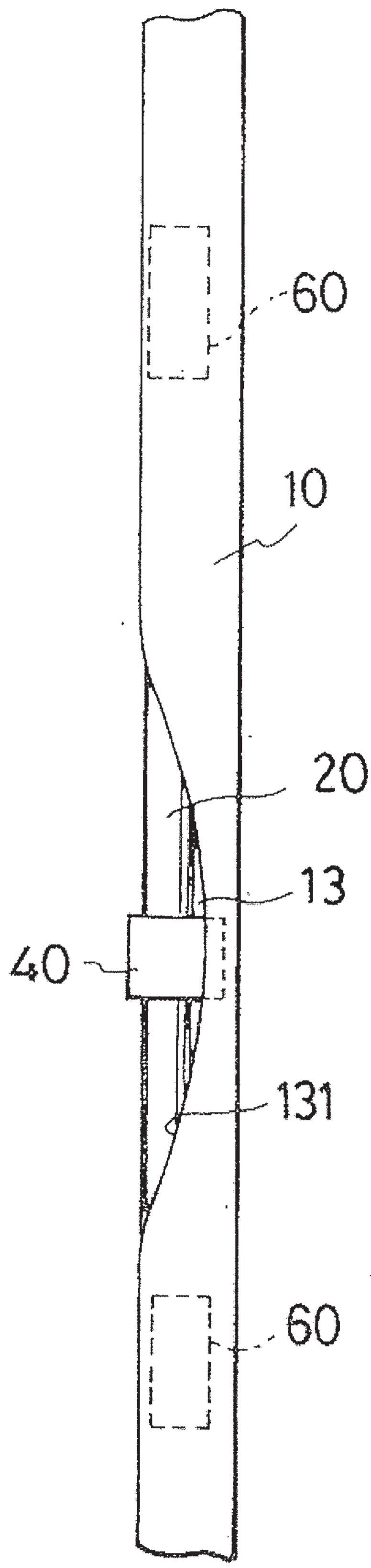


FIG. 11

United States Patent [19]

Montgomery et al.

[11] **4,203,342**

[45] **May 20, 1980**

[54] **DEVICE FOR AFFECTING DEFLECTION CONTROL OF AN ELONGATED MUSICAL INSTRUMENT SHAFT**

[76] Inventors: **John R. Montgomery**, 1020 Spruce St., Winnetka, Ill. 60093; **James S. Richards**, 945 E. Kenilworth, #330, Palatine, Ill. 60067

[21] Appl. No.: **945,306**

[22] Filed: **Sep. 25, 1978**

[51] **Int. Cl.**[2] **G10D 3/00**

[52] **U.S. Cl.** **84/293**

[58] **Field of Search** 84/275, 291, 293

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,446,758	2/1923	McHugh	84/293
1,912,106	5/1933	Turturro	84/293
2,056,474	10/1936	Low	84/293
2,100,249	11/1937	Hart	84/293
2,460,943	2/1949	Nelson	84/293
2,478,136	8/1949	Stromberg	84/293
3,159,072	12/1964	Burns et al.	84/293
3,901,119	8/1975	Siminoff	84/293
4,074,606	2/1978	Fender	84/293

FOREIGN PATENT DOCUMENTS

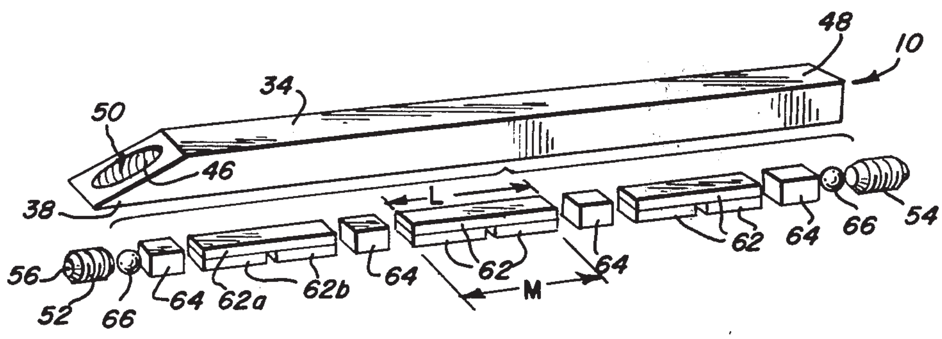
151283	8/1955	Sweden	84/293
967228	8/1964	Sweden	84/293
978931	1/1965	United Kingdom	84/293

Primary Examiner—L. T. Hix
Assistant Examiner—Benjamin R. Fuller
Attorney, Agent, or Firm—A. Andrew Olson, III

[57] **ABSTRACT**

A device for affecting deflection control of an elongated stringed musical instrument neck or shaft is provided to compensate for undesired neck deflections. The device includes a substantially rigid sleeve which is carried within and extends along the neck. At least one core element is removably positioned within the sleeve. A control element is adjustably secured to the sleeve and cooperates with the core element or elements to exert deflection control forces on the sleeve. The sleeve in turn, imparts such deflection control forces to the elongated neck or shaft in which it is carried.

16 Claims, 10 Drawing Figures



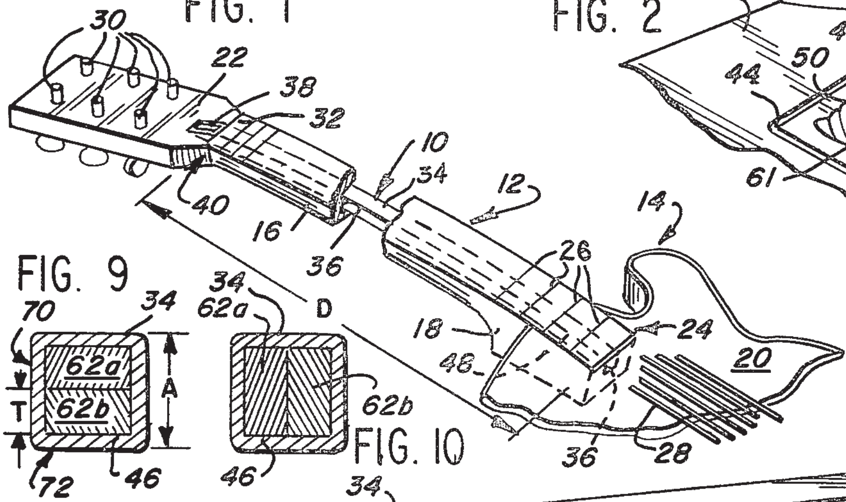


FIG. 1

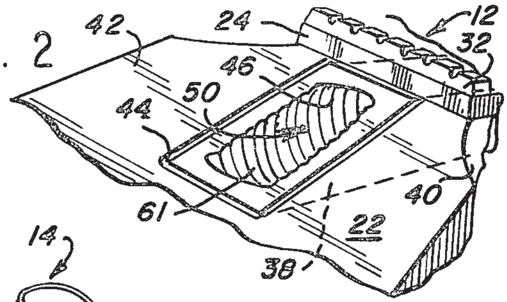


FIG. 2

FIG. 9 FIG. 10

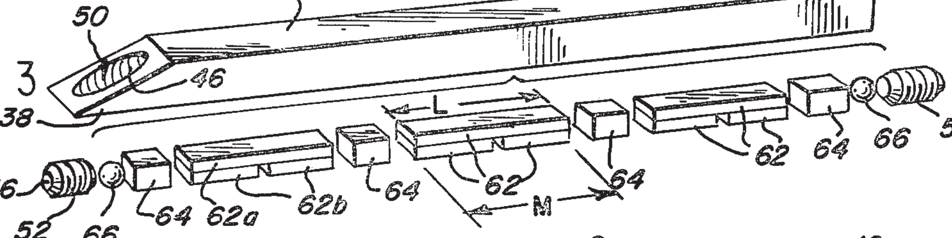


FIG. 3

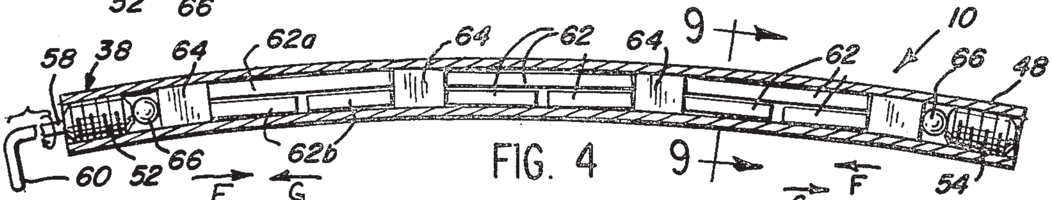


FIG. 4

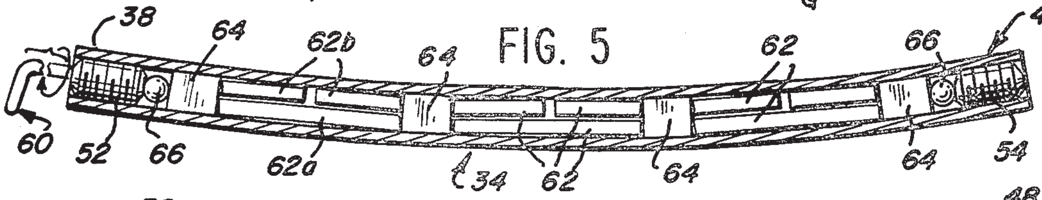


FIG. 5

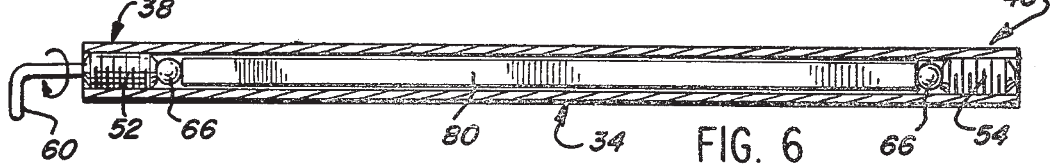


FIG. 6

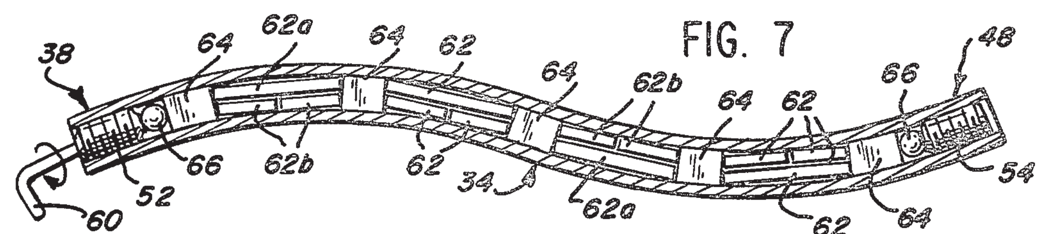


FIG. 7

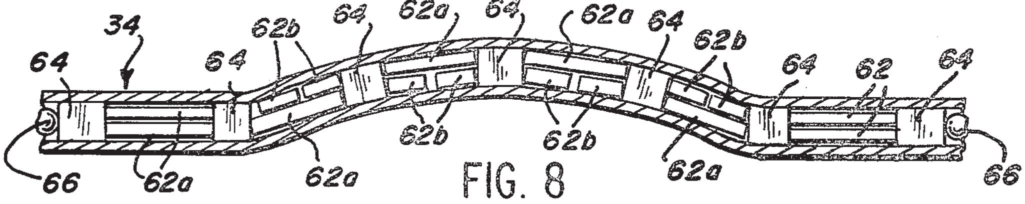


FIG. 8

DEVICE FOR AFFECTING DEFLECTION CONTROL OF AN ELONGATED MUSICAL INSTRUMENT SHAFT

BACKGROUND OF THE INVENTION

This invention relates to a device for affecting deflection control of an elongated shaft, and more particularly to a device for countering undesirable bending forces along the elongated neck of a stringed musical instrument.

In the modern design and construction of stringed musical instruments, the structural integrity of some components of the instrument, such as the elongated shaft or neck, may be detrementally affected by the dictates of certain aesthetic design considerations as, for example, the current market preferance for slim necks. In addition, the selection of materials from which the instrument is constructed may be prone to warpage or other structural deterioration encountered as the instrument ages and/or is exposed to the environment.

These inherent problems are particularly critical to the utility of a stringed instrument when they alter the camber or proper extension of the neck. This proper extension is critical because the tonal quality and playability of the instrument are directly related to the proper clearance and attitude of the strings as drawn over the instrument's neck, and over the pitch-defining ribs or frets along the neck - in the case of fretted instruments, such as the guitar.

Generally, to counter the undesirable distortion and lack of structural rigidity of the neck, a substantially rigid element or series of elements may be inserted or incorporated into the instrument's neck. The tension exerted by such elements may be adjustable or passive, and/or the elements or element may be removable from the neck to change the force-exerting characteristics thereof. However, the mere application of a tension force along the entire length of the neck does not account for the need to provide localized deflection control for warpage or the like, occuring along a short segment thereof.

In addition, devices that utilize the instrument neck as a component part of the adjustable structure, subject the neck to undesirable side-effect forces, which may result in concomitant distortions. In particular, compression and twisting, or torque, forces exerted on the neck by such devices may result in a loss of payability, tonal quality and intonation and sometimes promote a complete functional failure of the neck.

During the life of the instrument, it may become necessary to adjust or to completely alter the bending characteristics of the elements or element to compensate for newly discovered distortions of the neck. The substantial or complete removal of the elements or element from the neck may be necessitated and/or require delicate procedures and substantial amounts of time to achieve the desired bending qualities. If these procedures fail the entire neck must be replaced.

Finally, the structural integrity of the neck has been augmented by employing a rigid beam for enhanced stiffness. Employing a nonadjustable and rigid device within the neck may provide the desired structural integrity, but such a device is not adapted to correct undesirable deflections of the neck over the instrument's lifetime. And, utilization of a prior art device which is adjustable may require accurate and difficult adjustment and/or modification, exert undesired additional forces on the neck, provide unpredictable bending only over the extended length of the neck and still fail to achieve the desired results.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved, low cost device for affecting deflection control and structural integrity of the elongated shaft or neck of a stringed musical instrument.

It is another object of this invention to provide a device which is substantially rigid and yet adjustable to affect deflection control at predetermined locations along the neck of a stringed musical instrument.

It is still another object of this invention to provide a device that imparts substantially only the desired bending forces to the instrument neck, without subjecting the neck to additional and undesired forces.

It is yet another object of this invention to provide a device which is easily and quickly adjusted to correct undesirable deflections in the neck.

It is a further object of this invention to provide a device which may be utilized to enhance the structural stiffness of the neck in which it is carried.

Yet another object of the invention is to provide an easily removable and replaceable device for affecting deflection control and structural integrity of an elongated neck.

It is an additional object of this invention to provide a device which can correct longitudinal and/or lateral neck deflections which occur along or simultaneously along the neck.

SUMMARY OF THE INVENTION

These objects are achieved by a device according to the invention which includes a sleeve adapted to extend along the elongated shaft or neck of a stringed musical instrument. At least one core element is accommodated within the sleeve and is of a predetermined size and length. Adjustably secured to as least one end of the sleeve is a control element, which is adapted to cooperatively engage with the core element in the sleeve to affect predetermined and controlled deflection of the sleeve. The controlled deflection of the sleeve is imparted directly to the neck or shaft in which the sleeve is accommodated.

In one illustrative embodiment a substantially rigid elongated sleeve is positioned in a similarly dimensioned slot extending substantially longitudinally and centrally of the neck of a stringed musical instrument. The sleeve is provided with adjustable and complemental pistons at opposite ends thereof, capable of limited movement longitudinally of the sleeve. Within the sleeve and between the pistons which are adjustable secured thereto, are a plurality of core elements upon which the pistons may bear. The position and length of the core elements, and the cooperating engagement of the core elements with the pistons will affect predetermined deflection control of the sleeve in which the core elements are accommodated.

Other objects, advantages and features of the invention will become apparent upon reading the following detailed description and appended claims, and upon reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

For a complete understanding of this invention, reference should now be made to the embodiment illustrated in greater detail in the accompanying drawings and described below by way of an example of the invention.

IN THE DRAWINGS:

FIG. 1 is a fragmentary perspective view, partially cut away, of a stringed musical instrument showing the preferred embodiment of the device employing principles of this invention, in position within the shaft or neck of the stringed musical instrument.

FIG. 2 is an enlarged fragmentary perspective view of one end portion of the sleeve disposed within the musical instrument neck shown in FIG. 1.

FIG. 3 is an enlarged perspective view of the device of FIG. 1 showing the component parts in exploded relation.

FIG. 4 is an enlarged logitudinal sectional view of the device of FIG. 3 with the components parts thereof shown in one position of adjustment.

FIG. 5 is an enlarged longitudinal sectional view, similar to FIG. 4, but showing the device, and the component parts thereof, in a second position of adjustment.

FIG. 6 is an enlarged longitudinal sectional view, similar to FIG. 4, but illustrating the device and modified component parts thereof in a third position of adjustment.

FIG. 7 is an enlarged longitudinal sectional view, similar to FIG. 4, illustrating the device in a fourth position of adjustment.

FIG. 8 is an enlarged longitudinal sectional view, similar to FIG. 4, illustrating the device in a fifth position of adjustment.

FIG. 9 is an enlarged cross-sectional view of the device of FIG. 4, taken along the line 9—9 thereof.

FIG. 10 is an enlarged cross-sectional view, similar to FIG. 9, and illustrating an alternative configuration for the preferred embodiment of the device.

While the invention will be described in connection with a preferred embodiment, it will be understood that the description is not intended to limit the invention to that particular embodiment. On the contrary, it is the intent to cover all alternatives, modifications and equivalents as may be included with the spirit and scope of the invention as defined by the appended claims.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings and principally to FIG. 1, the preferred embodiment of a neck adjusting device **10** according to the invention is shown in position within the elongated shaft or neck **12** of a conventional stringed musical instrument **14**, such as an electric guitar.

The neck **12** is typically formed from a single piece of hardwood **16** or other solid material, and is of greater cross-dimensional thickness **18** where it joins with the body **20** or sound box, and tapers toward the headpiece **22**. The hardwood piece **16** is overlaid by a fingerboard **24** (FIG. 2). The fingerboard **24** is usually a strip of stiff material, such as rosewood or ebony, of near uniform thickness, being substantially co-extensive with the hardwood **16** thereunder. In the case of a guitar or other fretted stringed instruments, a plurality of ribs or frets **26** are secured in elevated relation to the fingerboard **24** running in substantially perpendicular relation to the elongated dimension D of the fingerboard **24**. The frets **26** are secured in a predetermined spaced relation along the neck **12** to achieve predetermined musical pitches when the strings **28** of the instrument are depressed by finger or other pressure into contact with a predetermined fret, and the strings **28** are struck, plucked, bowed or otherwise vibrated.

The strings **28** are secured at one end (not shown) to the sound box **20** and at the other end to string posts **30** which are adjustably secured in and extend through the headpiece **22**. The strings extend through a slotted nut **32** mounted at the juncture of the fingerboard **24** and the headpiece **22**. The nut **32** assures proper separation between adjacent strings **28**, and supports the strings **28** a predetermined distance over the fingerboard **24** and the raised frets **26**. Proper string tension is achieved by rotation of the string posts **30**, which wrap the excess string round the post **30**.

Because the string tension may be substantial, and due to the extensive length and narrow cross-sectional thickness of the neck **12**, it is often necessary to structurally support or grid the neck **12** to prevent unwanted deflection thereof which would result in a loss of playability. Such stiffening is accomplished by the incorporation or placement of a metal sleeve or tube **34** within the neck **12**, under the fingerboard **24**.

As shown in the preferred embodiment of this invention, the device **10** includes a substantially square and elongated steel tube **34** (FIG. 3), which is adapted for placement within a slot **36** cut into the neck **12** and extending its full length. The slot **36** and the tube **34** are of substantially the same dimensions to assure a close fit of the tube **34** within the instrument's neck **12**.

It is envisioned that the tube **34** is of substantially the same length as the neck **12**, and that the tube **34** will be substantially hidden by the placement of the fingerboard **24** over the hardwood **16** or other material. The tube **34** may be substantially shorter or longer than the neck **12**, without substantially detracting from the invention. Similarly, the slot **36** may act as and replace the tube **34**, although the neck **12** would thereby be subjected to additional and undesirable forces.

It is desirable, in most instances, to have an end of the tube **34** (FIG. 2) extend into the headpiece **22**. This is because the junction **40** between the neck **12** and the headpiece **22** is particularly structurally weak due to the relatively thin and flat cross-section of the headpiece **22**. The junction **40** is further weakened by the existence of the slot **36** or other similar opening which is frequently cut into the headpiece **22** to expose one end of the neck adjusting device **10**. This slot has been necessary in the past to allow for adjustment of prior art adjusting devices. However, such prior art devices have not, at the same time, acted to substantially reinforce the junction **40**.

According to this invention, the tube end **38** extends into the headpiece **22**, but may be bevelled or contoured to remain substantially flush with the upper surface **42** of the headpiece **22**, when the tube **34** is positioned within the neck slot **36**. In this way, the junction **40** between the neck **12** and the headpiece **22** is strengthened, while access to the device **10** for the purpose of adjustment is unabstructed, as hereinafter described. Although the device is effective without gluing or otherwise securing the tube **34** within the slot **36**, additional strength will be added to the junction **40** by gluing the tube **34** at that location. The exposed tube end **38** may be hidden, for aesthetic purposes, by the placement of a head plate **44** thereover.

The tube **34** defines a substantially square inner passage **46** (FIGS. 9, 10) extending the length thereof. The end portions **38**, **48** of the tube **34** have been tapped **50** to accept a threaded piston or plug **52**, **54** or the like therein. The tube **34** may be tapped along its entire length, if so desired, thus allowing full length longitudinal motion of the pistons **52, 54** and/or allowing the use of a plurality of said pistons.

Each piston **52, 54** includes an indented slot **56** on one end thereof, which is adapted to accept the working end **58** (FIGS. 4, 5, 6, 7) of an Allen wrench **60** or similar tool. Rotation of the pistons **52, 54** when engaged with the threads **61** of the tube **34**, as accomplished by the rotation of the Allen wrench **60** when inserted into piston slot **56**, will cause longtiudinal motion of the piston(s) **52, 54** within the tube **34**.

Positioned with the tube passage **46** between the pistons **52, 54** are a plurality of core elements **62** of predetermined thickness and length (i.e., shape). The core elements **62** may be separated from the pistons **52, 54** and from each other by core blocks **64** of substantially the same dimension as the inner passage **46**. As described hereinafter, the selection and placement of the core elements **62** within the tube passage **46** is directly related to the deflection characteristics of the device **10**.

The core elements **62** are generally, in thickness T (FIG. 9), ½ the dimension A of the inner passage **46** (see FIGS. 9, 10). The length L of the core pieces **62** between core blocks **64** will vary, depending on the deflection characteristics to be achieved. If any bending is desired between two core blocks **64**, however, the length L of one core piece **62***a* (FIG. 9, 10) will be longer than the combined or single length M of adjacent core piece or pieces **62***b*.

It should also be clear that the desired deflection characteristics are achieved by a single, irregularly-shaped core element of a thickness approaching dimension A and having a lengthwise dimension L along at least one part of the core element—as is achieved by permanently joining and securing facing core pieces **62***a*, **62***b* into a single core element. The core pieces **62***a*, **62***b* and core blocks **64** are each constructed from solid machined steel, or other material capable of maintaining its original shape when subjected to compressive forces.

Vibration of the core pieces **62***a*, **62***b* and core blocks **64** within tube **34** may be eliminated by restricting the motion of the core pieces **62***b* with grease or other matter.

Between the core blocks **64** at each end of the tube **34**, and the pistons **52, 54** are ball bearings **66** which minimize the resistance to rotation of the pistons **52, 54** when in an engaging relation with the bearings **66**, core blocks **64** and core pieces **62**, respectively. In addition, bearings **66** alleviate torque forces which might otherwise result if the pistons **52, 54** were rotated against the core blocks **64** or core pieces **62***a*, **62***b*.

In operation, the neck adjusting device **10** is positioned within the slot **36** cut into the neck **12** of a guitar **14** or other musical instrument. If large deviations or distortions **12** can be expected, the tube **34** of the device **10** should be secured along its full length with an epoxy glue or the like, to the hardwood portion **16** of the neck **12** defining the slot **36**. In this secured relation, the action of the tube **34** will be more completely and accurately transferred to the surrounding hardwood **16** of the neck **12**.

If, however, only small distortions of the neck **12** can be anticipated, it is not necessary to secure the device to the neck **12**, since the device does not depend upon the neck **12** to affect deflection of the sleeve **34**—i.e. the device is self-contained.

The slot **36** need only be a simple, square, straight dado cut in appearance, which thus presents a simple manufacturing task.

Prior to the placement of the tube **34** into the neck slot **36**, it may be desirable to rotate the piston **54** into position within the threaded end **48** of the tube **34**, because the end **48** of the tube **34** will usually be less accessable than the opposite end **38** of the tube **34**.

It will be understood, of course, that one of the ends **38, 48** of the tube passage **46** may be otherwise blocked or permanently closed without detracting from the scope of this invention.

Once secured or positioned within the neck slot **36**, the fingerboard **24** is secured to the hardwood **16**, over the tube **34**, leaving only the end portions **38, 48** exposed at the heatpiece **22** and at the opposite end of the slot **36** respectively. It should be noted, however, that because it is not necessary to fixedly secure the tube **34** within the neck **12**, and because the slot **36** is not contoured or sloped, the tube **34** may be inserted and/or removed from the slot **36** after the fingerboard **24** is in place. With the fingerboard **24** in place over the hardwood **16**, however, the tube **34** will be snuggly retained within the neck **12**.

When a determination is made that warpage or other distortion of the neck **12** has occurred, as by deterioration of playability or other observed characteristics, the core pieces **62** and core blocks **64** may be arranged and loaded into the passage **46** at the end **38** of the tube **34**, with the piston **52** moved into engaging relation with the ball bearing **66**, the core block **64** and the core pieces **62**, respectively, to counteract the detremental neck deflections.

For example, if it has been determined that the neck **12** has warped (i.e. that the headpiece **22** has moved vertically upwardly, viewing the instrument as shown in FIG. 1), a counteracting, generally downward force must be imparted to the neck **12**. As shown in FIG. 4, this counteracting downward force is accomplished by arranging the core pieces or elements such that the longer core pieces **62***a* overly, as in FIG. 4, the shorter core pieces **62***b*. It should be recalled that the combined length M (FIG. 3) of core pieces **62***b* is shorter than the length L of the longer core piece or pieces **62***a*.

When compressive force F (FIG. 4) is exerted against the core blocks **64** on opposite ends **38, 48** of the passage **46** by the longitudinal movement of piston **52** and bearing **66**, the force F will be exerted on the longer core pieces **62***a* along the upper ½ of the tube passage **46**. Correspondingly, a resultant tension force G (FIG. 4) will be imparted substantially along the upper ½ **70** (FIG. 9) of the tube **34**. Simultaneously, the lower portion **72** of the tube **34** will be subject to a lesser tension force. As a result, because the core pieces **62***b* are of shorter length M (FIG. 3) than the core pieces **62***a*, and are not abutting, the tube **34** will be deflected downwardly.

The amount of permissable deflection will depend, to a point, upon the differential in length between the longer and shorter core pieces **62***a* and **62***b*, respectively, the arrangement of said core pieces, the characteristics of the material of the tube **34**, and the tension imparted to the device **10** by the pistons **52, 54**. The number and lengths of the core pieces **62***a*, **62***b* will determine the smooth and/or localized deflection of the tube **34**.

Although some minimal stretching of the tube **34** may occur, the stretching will generally have a negligable effect on the structural integrity of the neck. No such stretching, of course, will be imparted to the neck if the device **10** is carried within, but not secured to the slot **36**.

FIGS. **5**, **7** and **8** illustrate additional bending characteristics and directional deflections that can be achieved by arranging the core pieces **62** and core blocks **64** according to the above teachings.

FIG. **6** illustrates the use of the device **10** as a girding structure imparting additional stiffness to the neck **12** by imparting additional stiffness to the tube **34**. A single core piece **80** may be utilized since no bending of the device **10** (FIG. **6**) is desired. Such stiffening will also correct minor deflections in the neck **12**.

If a plurality of core pieces **62** are used to simulate the solid core piece **80** (FIG. **6**), it will be understood that the combined lengths of the upper and lower sets of core pieces **62**_a_, **62**_b_ must be substantially equal. When the solid core piece **80** is replaced by a plurality of core pieces **62**_a_, **62**_b_, the individual upper and lower core pieces **62**_a_, **62**_b_ should be overlapped so as to avoid a co-terminal endwise alignment of individual upper and lower core pieces **62**_a_, **62**_b_. If such a co-terminal endwise alignment is achieved, undesired deflection of the device **10** may occur at the point of co-terminal alignment between core pieces.

It should be obvious from the above discussion that an elongated core piece **80** or pieces **62** may be employed in conjunction with shorter and/or various length core pieces **62**_a_, **62**_b_ to achieve desired localized deflection as in FIG. **8**.

While the core pieces **62** in FIGS. **3**, **4**, **5**, **7**, **8** have been overlaid as shown in FIG. **9**, with resulting deflection in the vertical, up-down, direction, it whould be noted that deflection in the horizontal direction can likewise be achieved by positioning the core pieces **62**_a_, **62**_b_ in a side-by-side relation as shown in FIG. **10**. Deflection control in other planes can be achieved by using 3 or more core pieces **62** to occupy the cross-sectional opening **46** in the tube, by installing the tube **34** on a different axis in the neck **12**, and/or by employing a different cross-sectional shape of the tube **34**.

Finally, depending on the selection of materials for, and the location and amount of tension exerted on the tube **34**, an inelastic deflection thereof may be accomplished. If a desired inelastic deflection of the tube **34** is achieved, the core blocks **64**, core pieces **62**, ball bearings **66** and pistions **52**, **54** can be removed from the tube **34**, to decrease the weight of the neck **12**.

Thus, a device is provided that is self-contained, replaceable, and capable of correcting and/or re-correcting an infinite number of improper neck deflections. While a particular embodiment of the invention has been shown, it will be understood, of course, that the invention is not limited thereto since modifications may be made and other embodiments of the principles of this invention will occur to those skilled in the art to which the invention pertains, upon consideration of the foregoing teachings.

It is, therefore, contemplated by the appended claims to cover any such modifications and other embodiments as incorporate those features which constitute the essential features of this invention, within the true spirit and scope of the following claims.

We claim:

1. A device for affecting deflection control of an elongated musical instrument member, comprising a sleeve adapted to extend along and be carried by the elongated member, sleeve deflection means of predetermined shaped, and selectively and removably positioned within said sleeve, and adjustable control means mounted on said sleeve and selectively coacting with said sleeve deflection means to affect controlled directional and locational deflection of said sleeve and the elongated member carrying said sleeve.

2. The device of claim **1**, wherein said sleeve deflection means includes a plurality of core elements of predetermined lengths.

3. A device for affecting deflection control of an elongated musical instrument member, comprising a sleeve adapted to extend along and be carried by the elongated member, sleeve deflection means including a plurality of core elements of predetermined lengths wherein a set of said core elements is disposed within said sleeve and includes first and secnd core elements of differential lengths disposed in face-to-face relation, and adjustable control means mounted on said sleeve and selectively coacting with said sleeve deflection means to affect controlled deflection of said sleeve and the elongated member carrying said sleeve.

4. The device of claim **3**, wherein said control means selectively engages the longer of said first and second core elements to affect controlled and predetermined deflection of said sleeve.

5. The device of claim **4**, wherein a plurality of said core element sets are disposed within said sleeve in end-wise relation, said adjacent core element sets separated by a core block piece disposed therebetween.

6. The device of claim **5**, wherein the longer core elements of said core element sets are disposed within said sleeve in substantially longitudinal alignment, affecting predictable single directional deflection of said sleeve.

7. The device of claim **5**, wherein a predetermined number of said longer core elements of said core element sets are disposed within said sleeve in substantially non-aligned relation, affecting predictable multi-directional deflection of said sleeve.

8. The device of claim **3**, wherein said first and second core elements of said core element set are disposed in overlying relation.

9. The device of claim **3**, wherein said first and second core elements of said core element set are disposed in side-by-side relation.

10. A device for affecting deflection control of an elongated musical instrument member, comprising a sleeve adapted to extend along and be carried by the elongated member, a pluralty of core elements removably disposed within said sleeve and arranged in sets of differential length first and second core elements disposed in face to face relation, said core element sets disposed in longitudinal end-wise relation, core block means disposed within said sleeve and between adjacent sets of said core elements, and adjustable control means mounted on said sleeve and selectively coacting with said core elements in said core element sets to affect controlled and predictable directional deflection of said sleeve and the elongated member carrying said sleeve.

11. The device of claim **10**, wherein said sleeve is a substantially rigid open-ended tube, said tube including a threaded portion therealong.

12. The device of claim **11**, wherein said adjustable control means includes a threaded piston disposed within and adjustably mounted to said tube along the threaded portion thereof.

13. The device of claim 12, wherein said piston adjustably coacts with the longer core element of said core element sets to affect controlled directional deflection of said tube.

14. The device of claim 13, wherein a threaded piston is adjustably mounted in said tube toward each opposite end of said tube.

15. The device of claim 14, wherein said pistons engage core block means disposed within said tube between said pistons and a set of said core elements.

16. The device of claim 15, wherein a bearing means is provided between said core block means and said threaded pistons.

* * * * *

D2

United States Patent [19]

Boucher

[11] 4,308,780

[54] **WARP RESTORING DEVICE FOR THE NECK OF A STRINGED MUSICAL INSTRUMENT**

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[21] Appl. No.: **140,983**

[51] **Int. Cl.**[3] **G10D 3/00**
[52] **U.S. Cl.** **84/293**
[58] **Field of Search** 84/267, 293

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,460,943 2/1949 Nelson 84/293
3,416,399 12/1968 Baldoni 84/293
3,443,018 5/1969 Krebs 84/293

FOREIGN PATENT DOCUMENTS

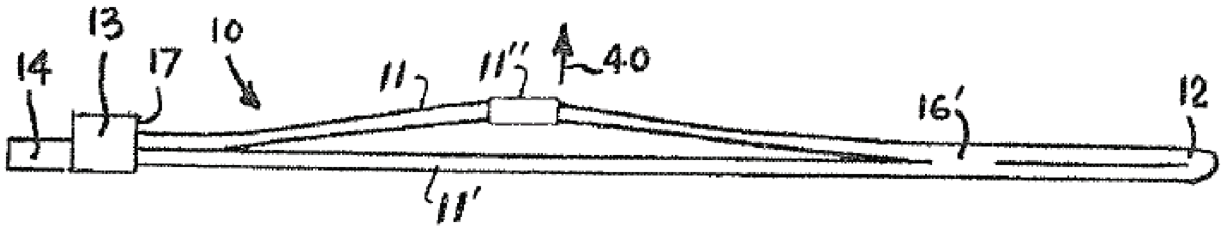
1908603 9/1970 Fed. Rep. of Germany 84/293

Primary Examiner—Lawrence R. Franklin
Attorney, Agent, or Firm—Alan Swabey; Robert Mitchell; Guy J. Houle

[57] **ABSTRACT**

A warp restoring device for use in a neck of a stringed musical instrument. The device comprises a pair of rods held in parallel relationship. A connecting block is secured at a common end of the rods. A threaded member cooperates with the connecting block to cause limited axial displacement of one of the rods. A rod connection is spaced from a far end of the rods to immovably interconnect both said rods in a connection zone to control the position of a bending zone for the rods when the threaded member is rotated in a predetermined direction.

10 Claims, 5 Drawing Figures



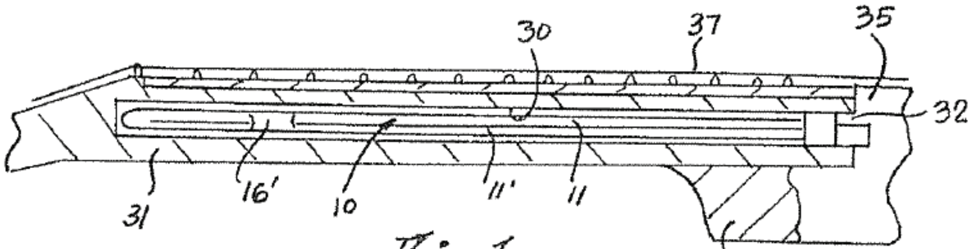


Fig. 1

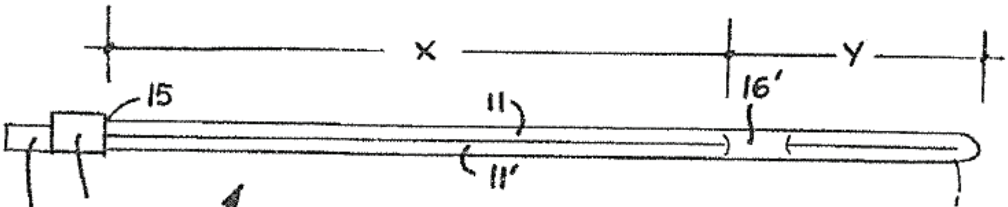


Fig. 2

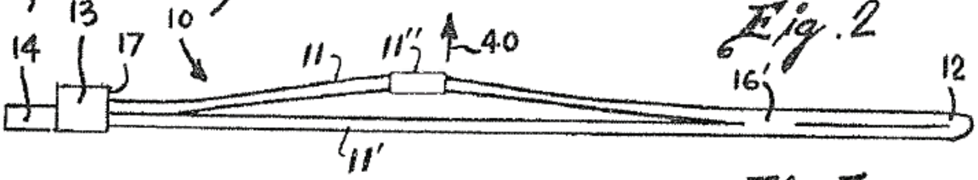


Fig. 3

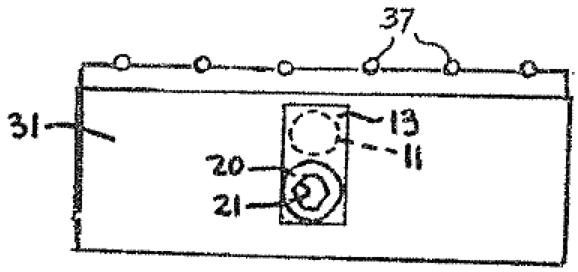


Fig. 4

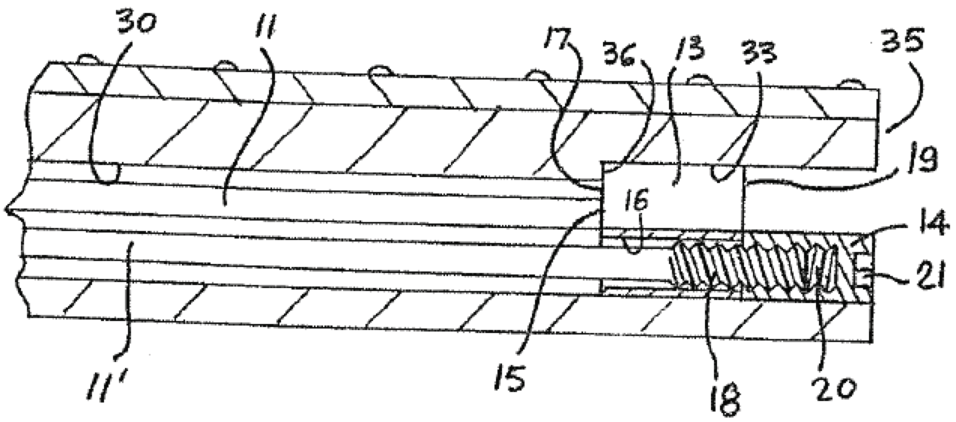


Fig. 5

WARP RESTORING DEVICE FOR THE NECK OF A STRINGED MUSICAL INSTRUMENT

BACKGROUND OF INVENTION

(a) Field of the Invention

The present invention relates to a warp restoring device for use in the neck of a stringed musical instrument whereby to counteract warping of the neck.

(b) Description of Prior Art

Various types of reinforced necks for stringed musical instruments are known. The most pertinent prior art known to the Applicant is the guitar neck construction as disclosed by U.S. Pat. No. 2,460,943 issued on Feb. 8, 1949. In that patent, there is shown a neck straightening means constituted by two elongated rods which are vertically disposed in a cavity formed in the neck and adjustable to counteract warping of a guitar neck caused by tension of the strings or climatic effects. In this patent, the rods are immovably secured to one another at a far end and by displacing one of the rods axially, the other will bow out to apply a restoring pressure. However, when the rods are in tight fit with the slot in the guitar neck, the restoring pressure, being throughout the length of the rods, is displaced to its weakest resisting area and often the restoring force is of no benefit.

Further, in the prior art, the rods are inserted from the forward end of the neck and an end part thereof is visible. Also, the slot formed in the neck is visible at its end and this is displeasing to the aesthetics of the instrument.

SUMMARY OF INVENTION

The present invention is an improvement over the warp restoring device as described in the above-mentioned prior art and overcomes the above-mentioned disadvantage thereof, by controlling the position of the restoring force in the rods.

A further feature of the present invention is to conceal the restoring device in the neck of a guitar by providing the opening of the slot in the neck in the hollow body of the instrument in proximity to the sound aperture to permit insertion and adjustment of the restoring device.

Another feature of the present invention is to provide a warp restoring device for use in a neck of a stringed musical instrument whereby the device is reversible to counteract warping of the neck in either one of opposed directions.

Another feature of the present invention is to provide a warp restoring device for use in the neck of a stringed musical instrument whereby the bending zone of the rods is controlled by the provision of a rod connection spaced from a far end of the rods and independent of the guitar neck.

Another feature of the present invention is to provide an improved warp restoring device which employs very few parts, is easy to construct, and easy to adjust and wherein the device is concealable within the neck of a stringed musical instrument.

According to the above features, from a broad aspect, the present invention provides a warp restoring device for use in a neck of a stringed musical instrument. The device comprises a pair of rods held in parallel relationship. Connecting means is secured at a common end of the rods. Threaded means cooperate with the connecting means to cause limited axial displacement of one of the rods. A rod connection is spaced from a far end of the rods to immovably interconnect both of the rods in a connection zone to control the position of a bending zone for the rods when the threaded means is rotated in a predetermined direction.

BRIEF DESCRIPTION OF DRAWINGS

A preferred embodiment of the present invention will now be described with reference to the example thereof as illustrated in the accompanying drawings in which:

FIG. 1 is a fragmented sectional view of the neck portion of a stringed musical instrument showing the location of the warp restoring device therein;

FIG. 2 is a plan view of the warp restoring device of the present invention;

FIG. 3 is a plan view showing the warp restoring device in a condition of use illustrating the bending zone and the connecting zone of the rods;

FIG. 4 is a fragmented end section view showing the construction of the connecting block and its location in the open end of the cavity formed in the neck of the musical instrument; and

FIG. 5 is an end view showing the position of the warp restoring device.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the drawings, and more particularly to FIGS. 2 and 3, there is shown generally at 10, the warp restoring device of the present invention. As shown in FIG. 2, the warp restoring device comprises a pair of rods 11 and 11' held in parallel relationship to one another. Herein, there is a single rod 11 being bent at a far end 12 to constitute the pair of rods 11 and 11'. A connecting means, herein a connecting block 13, is secured at a common end of the rods. A threaded member 14 cooperates with the block 13 and connects to the rod 11', as will be described in detail later, to cause axial displacement of the rod 11' with respect to the rod 11 which is immovably secured at its end 15 within the block 13. A rod connection, herein a weld connection 16', immovably secures the rods 11 and 11' at a position spaced from its far end 12. This position is herein shown as being at approximately four inches from the far end 12 with the length of the rods being approximately fourteen inches.

Referring now to FIG. 5, there is shown the construction of the connecting block 13 and it consists of a brass block having a through bore 16 extending from an end face 17 of the block 13. As previously described, the end 15 of the rod 11 is immovably secured in the end face 17 of the block 13.

The rod 11' has a threaded end portion 18 extending through the bore 16 and out of the front face 19 of the block 13. The threaded member 14 is provided with an elongated threaded bore portion 20 which is in threaded engagement with the threaded end portion 18 of the rod 11'. An engageable means, herein constituted by an Allan keyhole 21, is provided at the opposed end of the threaded member 14 whereby to cause axial rotation of the threaded member 14 to displace the threaded end portion 18 of rod 11' axially within the through bore 16.

Referring to FIG. 3, it can be seen that by rotating the threaded member 14 to axially displace the threaded end portion 18 of the rod 11' into the connecting block 13 inwardly of the end face 17 thereof, that this tension in the rod 11' will cause the rod 11 to arc outwardly away from the rod 11' as the rod 11' is becoming shorter in its bending zone x. This bending zone is defined as the area between the end face 17 of the connecting block 13 and the rod connection 16'. The length of the rods which are immovably retained by the connecting weld 16' forms a connection zone y. This connection zone adds rigidity to the rods 11 and permits to control the precise position of the bending zone x where it is necessary to exert the maximum restoring pressure whilst permitting to conserve a mean pressure in the other areas along the length of the rods.

In use, and as shown in FIG. 1, the warp restoring device 10 is positioned within a longitudinal cavity 30 which is formed in the neck 31 of a musical instrument 32, herein a guitar. This cavity 30 is an elongated narrow vertically extending cavity which is disposed in the neck 31 of the instrument and has an open end 32 located in the body 34 of the guitar under the sound aperture 35 formed in the top face thereof under the strings 37. The opening 32 permits insertion of the device 10 within the neck. By disposing the device 10 through the aperture 35 of the guitar, the end member 14 is concealed, unlike the prior art where the adjustment is from the opposite end of the neck where the device is visible.

As shown more clearly in FIG. 5, the open end portion of the cavity has an enlarged area 33 whereby to locate the connecting block 13 in close fit therein. The end face 17 of the connecting block also serves as an abutment face for the connecting block 13 against ledge 36.

It can be seen that by providing a vertically extending cavity 30 in the neck 31 of the instrument 32 and positioning the rods 11 and 11' aligned vertically with respect to each other, that the restoring force of the rod, in the direction of arrow 40 in FIG. 3, can be applied upwardly or downwardly along the transverse axis of the neck 31 by simply positioning the rod 11' lowermost or uppermost in the cavity 30. As shown in FIG. 4, the connecting block 13 is of a rectangular cross section, and fits into the enlarged portion 33 of the cavity in either opposed vertical positions. Thus, by the provision of a means to select the direction of the restoring force, correction of warping in both directions is possible. Also, the device provides for a decrease in the rejection of warped instrument necks that results during the production of same. Furthermore, the rods 11 and 11' may be constructed of materials having different strengths. For example, it is recommended that for stringed instruments, such as classical guitars, that the rods 11 and 11' be constructed of aluminum. In the case of a western-type guitar, the rods would be constructed of steel. In the event where the neck 31 of the instrument is of a material sensitive to pressure, then the rods may be formed of any desired material that will suit the material from which the neck is constructed.

The rod 11 may comprise a thickened portion 11" that provides the portion of the rod 11 that engages with the material of the neck of the instrument when the rod 11 is flexed. The thickened portion 11" may comprise a material that is harder than the relatively flexible material of the remainder of the rods 11, 11'. The flexible material provides ease of flexing of rod 11, while the hardened thickened portion 11" prevents damage of the surface of the rod 11 against the material of the neck of the instrument.

It is within the ambit of the present invention to cover any obvious modifications of the example of the preferred embodiment described herein, provided such modifications fall within the scope of the broad claims.

CLAIMS:

1. A warp restoring device for use in a neck of a stringed musical instrument, said device comprising a pair of rods held in parallel relationship, connecting means secured at a common end of said rods, threaded means cooperating with said connecting means to cause limited axial displacement of one of said rods, and a rod connection spaced from a far end of said rods to immovably interconnect both said rods in a connection zone to control the position of a bending zone for said rods when said threaded means is rotated in a predetermined direction.

2. A device as claimed in claim 1 wherein said connection means is a support block, said rod connection being a weld connection formed between said pair of rods.

3. A device as claimed in claim 2 wherein said pair of rods are positioned in a longitudinal cavity formed in said neck of a stringed instrument, said cavity being a narrow vertically extending cavity having an open end located in a hollow body of said instrument and accessible through a sound aperture in said body.

4. A device as claimed in claim 3 wherein one of said rods is immovably secured to said connecting block, the other of said rods having a threaded end portion extending in a bore in said block and axially displaceable therein by tightening or untightening said threaded means.

5. A device as claimed in claim 4 wherein said bending zone extends arcuately upward from the normal axis of said axially displaceable rod, said pair of rods being disposed in said cavity of said neck with said axially displaceable rod being lowermost.

6. A device as claimed in claim 5 wherein said rods are reversible in said cavity of said neck with said axially displaceable rod being uppermost.

7. A device as claimed in claim 3 wherein said rods are of circular cross-section, said block being a rectangular block having a rod connecting end face, one of said rods being immovably secured in said connecting end face, the other of said rods having a threaded end portion extending in a through bore in said end face and axially displaceable in said block by tightening or untightening said threaded means.

8. A device as claimed in claim 7 wherein said threaded means is a threaded member having an elongated threaded bore at one end thereof to receive said threaded end portion of said rod in threaded engagement, and engageable means at an opposed end of said threaded member to cause axial rotation thereof whereby said threaded end portion will be displaced axially in said threaded bore.

9. A device as claimed in claim 2 wherein said stringed instrument is a classical guitar, said rods being aluminum rods, said block being constructed of brass material.

10. A device as claimed in claim 2 wherein said stringed instrument is a western-type guitar, said rods being steel rods, said block being constructed of brass material.