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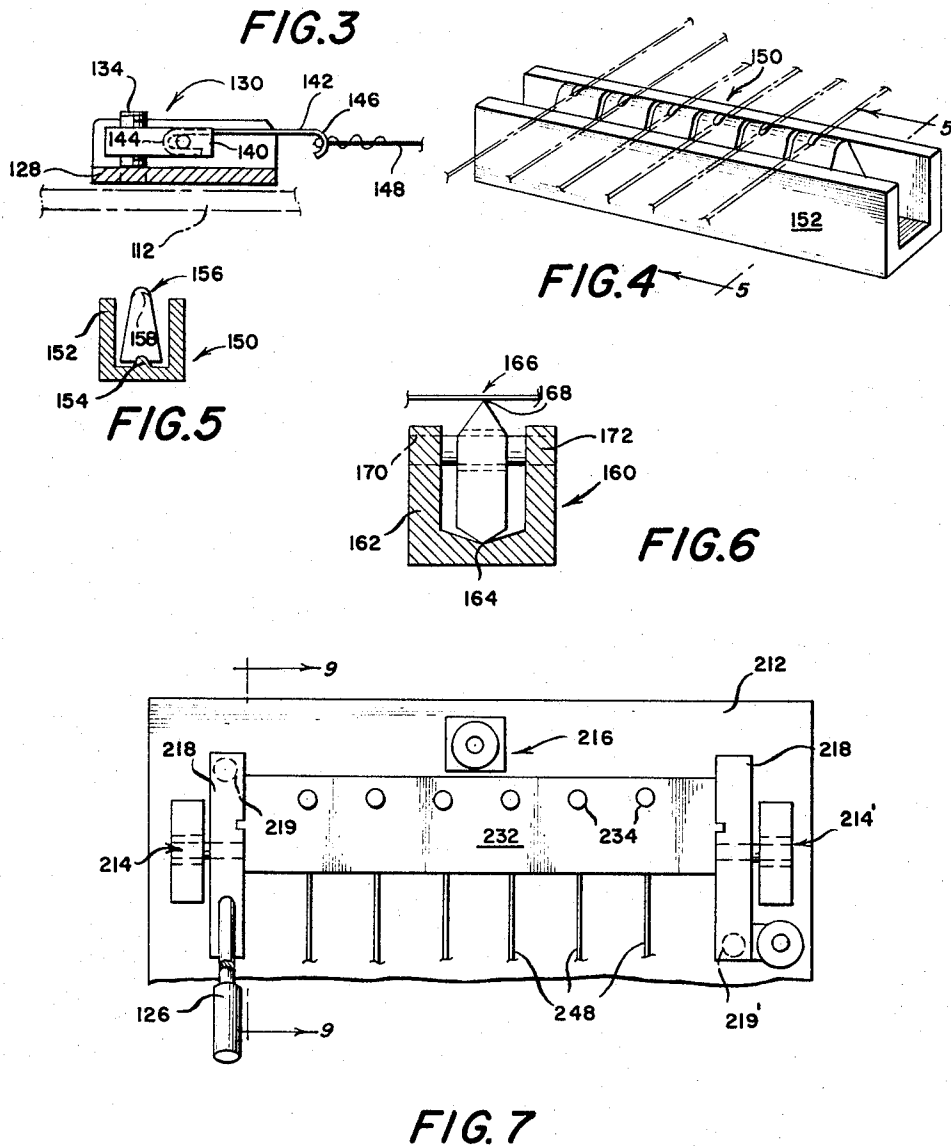
R. S. JONES

3,411,394

FRETTED INSTRUMENTS TREMOLO-VIBRATO TUNING SYSTEM

Filed June 29, 1965

3 Sheets-Sheet 2



INVENTOR

RALPH S. JONES

BY *Semmes & Semmes*

ATTORNEYS

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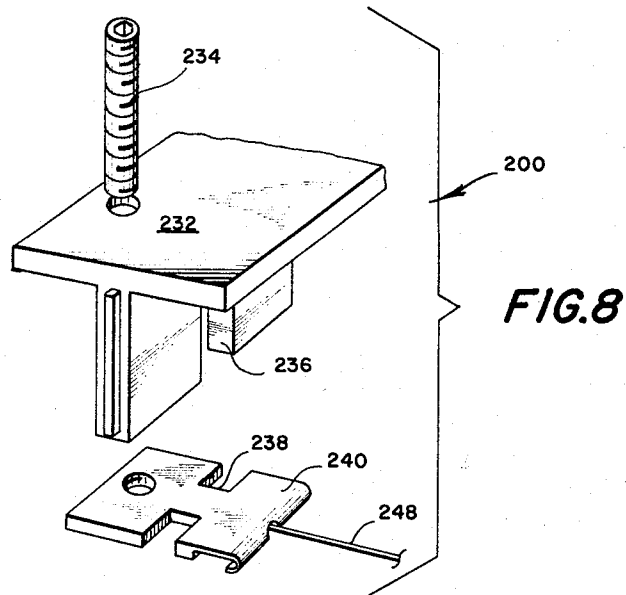
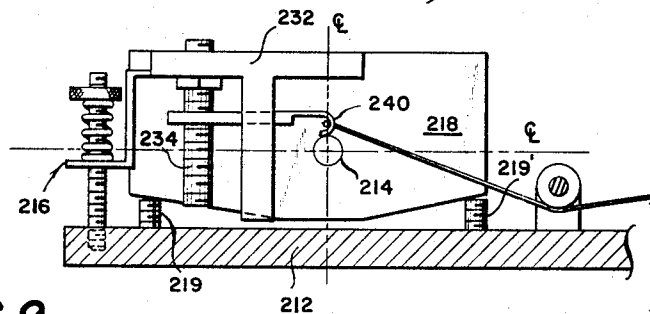
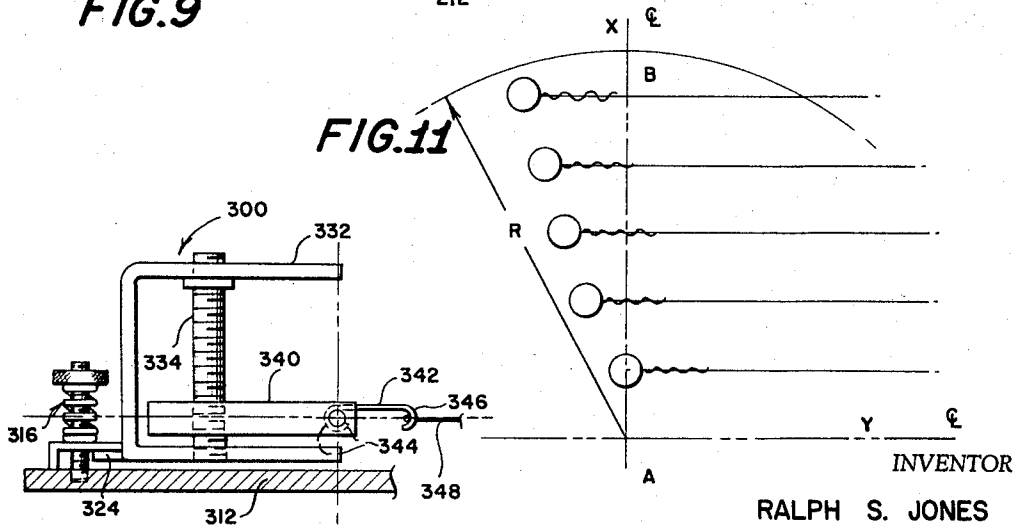


FIG. 10

INVENTOR
RALPH S. JONES

BY *Semmes & Semmes*
ATTORNEYS

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FRETTED INSTRUMENTS TREMOLO-VIBRATO TUNING SYSTEM

Ralph S. Jones, Hyattstown, Md., assignor to Mirco-Frets Corporation, Frederick, Md., a corporation of Maryland

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ABSTRACT OF THE DISCLOSURE

This is a tuning aid for fretted musical instruments such as guitars having tremolo and/or pitch modulation control. It is a novel combination of individual string bridge and anchor means therefor, which is adapted to maintain correct tuning of all strings while applying tremolo (pitch modulator) control in the playing of the instrument.

In the art, no provision has been made for the variation in diameter and tension at the position known as "normal tune" or at correct pitch for playing. No compensation in structure or method has been considered, in the past, to effect precise tuning string for string irrespective of its diameter or applied tension. No means is known for mounting such correct pitch or normal tune during actuation of the tremolo system.

At present, tremolo or vibrato is applied to the guitar through a tremolo unit comprising a means for simultaneously lengthening or diminishing the length of the strings of the instrument by lever action used in conjunction with an intermediate bridge for the strings, such devices being well known and in current use. These prior art devices include the tremolo lever-connected string reel means for adjusting the respective strings in tension. Often this is accompanied by a floating bridge with the disadvantage of uneven pitch variation or distortion upon adjusting either the anchor or the bridge or both. Individual adjustment to the strings has received study by Clarence L. Fender and others, but not by means of the tremolo control unit, as in this instance. Accordingly, an objective of invention resides in establishing and retaining tuned pitch without variance between respective strings, in musical instruments adapted to tremolo-vibrato control.

There is an additional objective in seeking to establish uniform tremolo control of guitars and related instruments in which the action between various strings of the instrument may be individually pre-set uniformly on all strings without variance to the tuning pitch thereof.

The invention is best illustrated in the drawings, wherein:

FIG. 1 is a view in perspective of a stringed instrument embodying the combination tremolo-vibrato control and associated bridge;

FIG. 2 is an exploded view in perspective of the FIG. 1 control elements both fixed and movable;

FIG. 3 is an end elevational view of the one unit of the anchor system of FIG. 1;

FIG. 4 is a perspective view of the bridge of FIGS. 1 and 2;

FIG. 5 is a sectional view of the multiple bridge mount of FIG. 4 taken along the lines 5—5 thereof;

FIG. 6 is a sectional view of another related multiple bridge mount;

FIG. 7 is a top plan view of the assembled tremolo-vibrato anchor system of FIG. 1;

FIG. 8 is an exploded fragmentary view of modification of the anchor system;

FIG. 9 is the complete assembly of the FIG. 8 modification showing fixed and pivoting mounts;

FIG. 10 is a modification of string anchor systems;

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FIG. 11 is a schematic illustrative of variant radii of a string, showing increased sensitivity in proportion to increased string radius from centerline.

In this invention, the adjacent strings of the instrument are each attached at their anchor ends to mountings which may be adjusted radially, whereby the tension of each string may be radially varied. In cooperation with the tremolo control terminus are plural floating or rocking bridge sections, one each for the respective strings, but all mounted in an adjustable housing.

To enhance comparatively equal variation in tension between corresponding strings of the instrument, the system is devised herein of partially diminishing or increasing the tension of the respective strings by providing each bridge with its pivot, one for each string, the respective bridges being adapted to move arcuately in limited longitudinal direction, at the point of contact with the individually engaging strings. In the present system hereinafter described in more complete detail, this bridge control is effected by a rockable or arcuately movable bridge. The degree of change in elevation of the point of string contact with the bridge will depend upon the design of the top of the bridge. For example, a pointed top will normally give a more abrupt change than would an arcuate top. The arcuate or radius top bridge could actually be moved the same degree as its arc without changing the elevation of the string.

The problem of uneven tuning, string to string, is overcome by the combination of the aforementioned bridge with terminal string tensioning or radius adjustment means. This tensioning means is known as the vibrato tailpiece. Here the tailpiece is broken down into individually eccentrically mounted elements to maintain the tuning balance of the respective strings and too, the accompanying bridge must be compartmented or provided with individual string sections as will appear more fully, below.

The fretted neck instrument 100 of FIG. 1 is provided with tremolo-vibrato control 110, and associated bridge 150.

In FIG. 2, the tremolo-vibrato control is shown to be composed of a base plate 112, adapted to fixed engagement with the musical instrument itself and including pivot trunnions 114 for the raised, pivotable string anchor system 128, an elevational section view of which is shown in FIG. 3.

Plate 112 includes, in addition to the trunnions 114, an anchor system tension station 116, which includes tension adjusting screw 118, spring 120 and the spring biased abutment 122 with corresponding screw fixed thereto. It will be apparent from an examination of FIG. 2 that the corresponding movable portion of the tremolo-vibrato control includes a corresponding shoulder 124, similar means of adjusting tension being well known to those skilled in the art. See the lever 126 secured within anchor block 128, the latter block being suitably pivoted in trunnion 114.

The anchor system 130 is best shown in FIG. 3, where the individual string adjustment means are shown in fixed engagement with the pivotally mounted anchor block 128. In this FIG. 3 system, the anchors 140 seat each adjusting screw 134 in friction bearing relationship to the anchor block 128, creating thereby adjustment for raising and lowering the individual string anchors 140, these in turn provide a pivotal mount for the S-shaped string terminus 142. Terminus 142 defines ends 144 and 146, the string 148 being shown in engagement with end 146 thereof. In this FIG. 3, the tension equalizing system is not shown in connection with shoulder 124 of the anchor block 128, as it is in FIG. 1. The string is secured to a suitable T-bar, the same engaging a slot, not shown, in the string terminus end 146. This particular arrangement

permits of individual variation in string radius from centerline through screw adjustment, avoiding, by reason of the pivotal relationship between anchor and string, any undue friction on the string at its anchor point. As will be apparent, each string is anchored accordingly for its individual adjustment. There is no connection between string anchor assemblies, excepting that each is mounted in-line in common channel member 132.

One form of plural section bridge used in conjunction with the invention is shown in FIGS. 4 and 5 and another is shown in FIG. 6. The bridge may itself be adjusted in a longitudinal transverse or vertical direction. Once thus adjusted, it provides individually adjustable bridge seats for the respective strings, acting in cooperation with corresponding string radius control shown in FIGS. 3 and 7. By virtue of the limited pivotal mount for the respective string engaging bridges 154, residing in the U-shaped housing 152, a slight variation in tension between the respective strings may be made to change the elevation and pitch individually. In the trade, a similar arrangement is known as a "floating bridge" but none has been created for cooperative effect with radius control adjustment being available to the musician, giving him the maximum in tonal variation from string to string. The respective bridges 156 are pivoted in the U-shaped mount 152. The mount 152 defines a central transverse pivot 154, adapted to support each bridge section 156 in rocking relation to the longitudinal axis of the instrument. The string engaging depression is indicated at 158 and it is shown in FIG. 5 to define a circular segment at its top. Referring to FIG. 4, the sections are slidable along the pivot to provide a selective spacing of the strings.

The alternate arrangement is shown in FIG. 6, in which it will be noted that the respective bridges are mounted for more sensitive adjustment avoiding thereby any dampening effect such as may be brought on by arcuate string contact as in the FIGS. 4 and 5 bridge complex. For example, note that in the FIG. 5 innovation, the strings are engaged along a substantially more extensive radius than at the apex point of contact in the FIG. 6 innovation. Moreover, in the FIG. 6 unit, each section 166 is limited to rockable motion coaxially with its string and the section is restrained against transverse displacement by loose fitting with a pin 170 fixed to walls 162 of channel 160. In the FIG. 6 innovation, the U-shaped channel member 160 includes the pivot apex 164 formed in the channel 162. The apex of the bridge section 166 appears at 168 to be a substantial peak to engage each individual string.

A further modification of invention is shown in FIGS. 7, 8 and 9 where the tremolo-vibrato system is mounted on a fixed block 212 having trunnions 214, and tension control 216, the pivotal mount for the tremolo control being shown at 214, and 214'. The pivotal mount includes tongue and groove fitting end plates 218. These end plates are held in spaced relation by the T-bar 232 and by location of adjustment screws 219 and 219' in the front and rear of each, the desired position for tuning can be obtained, lowering or raising the tremolo control. These screws 219 and 219' are movement limiting screws for the tremolo control and bear upon the plate 212 to limit the range. The T-shaped adjusting block 232 is thus adapted to receive the individual anchor control screws 234. These screws in turn are aligned longitudinally with vertical anchor guide channel 236 (FIG. 8) which in turn is adapted to receive anchor block 240 in sliding (238) radius adjusting control as assembled in FIG. 9. It will be appreciated that whereas only one adjusting system is shown in the tremolo-vibrato control 200 of FIGS. 8 and 9, the system is adapted to the individual radius adjusting control of six or more strings on any one stringed instrument as in FIG. 7. In FIG. 9, for example, the anchor 240 has been adjusted above the centerline indicated at the junction of the lines CL. This imaginary

centerline is coaxial with the pivot point for the tremolo-vibrato control generally indicated at 214 and 214'. In FIG. 9, the pivot is, as always, on the centerline, per se.

The modification 300 illustrated in FIGURE 10 depicts an adjustment housing 332 pivotally mounted on a fixed base 312 (as is the FIG. 1 unit). In this innovation, however, the housing per se is connected for restrained tremolo-vibrato action by the system 316 engaging a corresponding abutment 324. In this system, the radius control for each respective string comprises vertically adjustable anchor block 340 having a pivot at one end, adapted to pivotal engagement with link 342 at its end 344; its end 346 accommodating by nonfrictional engagement the terminus of the string 348, fitted by T-bar into an appropriate slot of the link at 346.

In FIG. 11, a schematic of the effect derived from individual adjustment of the respective strings appears. In this example, the centerline "x-y" illustrates that by an increase in the radius of a string from the lowermost (centerline) to the uppermost portions, there results an increased sensitivity in the respective adjusted strings to tremolo-vibrato control, since a shorter movement of the lever 126 brings about an increased diminution or increase in the radius of the string from the centerline.

From the foregoing, it will be appreciated that as in conventional models, the one hand lever moves all strings—but each string is adjusted individually, and travels a separate distance—to produce the correct tension to maintain constant relative pitch variation. All strings are in true harmony, no matter how little or how much tremolo or vibrato is applied. In this invention, no detuning of high-pitched strings occurs due to overstretching; a fixed stop provides for easy tuning, and a broken string will not effect pitch of other strings.

A floating bridge is compatible with independently moving sections for each string.

From the structure shown, for example, FIGS. 3, 9, and 10, it will be appreciated that the strings may be adjusted below the horizontal centerline. Thus, when one or more strings are below this point, the action of movement of the string is reversed. Nevertheless, if all strings are below the centerline, it gives the musician the identical performance as in the instance wherein all strings are above; excepting it gives him a choice of lifting or depressing the lever action to his particular technique. As indicated, this reverse action of lever, of course, is also spring balanced for tension. The resultant variety of opposite tone effects may be an inducement for unlimited experimentation by the musician in this area.

The invention is thus to be restricted only in accordance with the appended claims, various means of carrying out the invention being obvious to those skilled in the art.

I claim:

1. A musical instrument comprising:

(A) a body and strings secured in tension relation to ends of the body,

(B) pitch modulator control means for the strings adjacent lower end of the body comprising:

(1) pivot means fixed to the body defining an horizontal center-line,

(2) a string anchor plate pivotable within the said pivot means about said center line, said anchor having:

(a) individual string anchor blocks carried by said plate; said anchor blocks and strings being pivotally interconnected, said anchor blocks engaging vertically adjustable string tension means mounted on the anchor plate to vary the radius of each string from the centerline and maintain true horizontal movement of said strings in playing,

(3) pivotal bridges on the body aligned with each said anchor contact supporting each said string in pivotal connection; whereby upon the vertical

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adjustment of the anchor to move strings relative to the centerline to maintain undeflected tension, constant relative pitch variation and true harmony between strings, irrespective of amount of tremolo or vibrato applied thereto, whereby to achieve precise modulation between respective strings, irrespective of variation in size thereof and variable tension applied thereto in playing.

2. Musical instrument according to claim 1 further comprising: link means, pivotally interconnecting said strings and anchor blocks. 10

3. Stringed instrument tremolo-vibrato control system according to claim 2 in which the respective bridges define accurate channels to receive corresponding strings 15 in tension adjustment relation.

4. Stringed instrument tremolo-vibrato control system of claim 2 in which the respective bridges define a substantially pointed ridge to engage the strings in adjustable relation. 20

5. The musical instrument of claim 2, in which the

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radius adjustment of strings are variably disposed at or above horizontal centerline.

6. The musical instrument of claim 2, in which the radius adjustment of respective strings are each disposed variably at or below horizontal centerline.

7. The musical instrument of claim 2, in which the radius adjustment of respective strings are variably disposed at horizontal centerline, and above and below.

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RICHARD B. WILKINSON, *Primary Examiner.*