May 6, 1969 L. KREBS 3,443,018

GUITAR OR LIKE STRINGED MUSICAL INSTRUMENTS

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FIG. 1

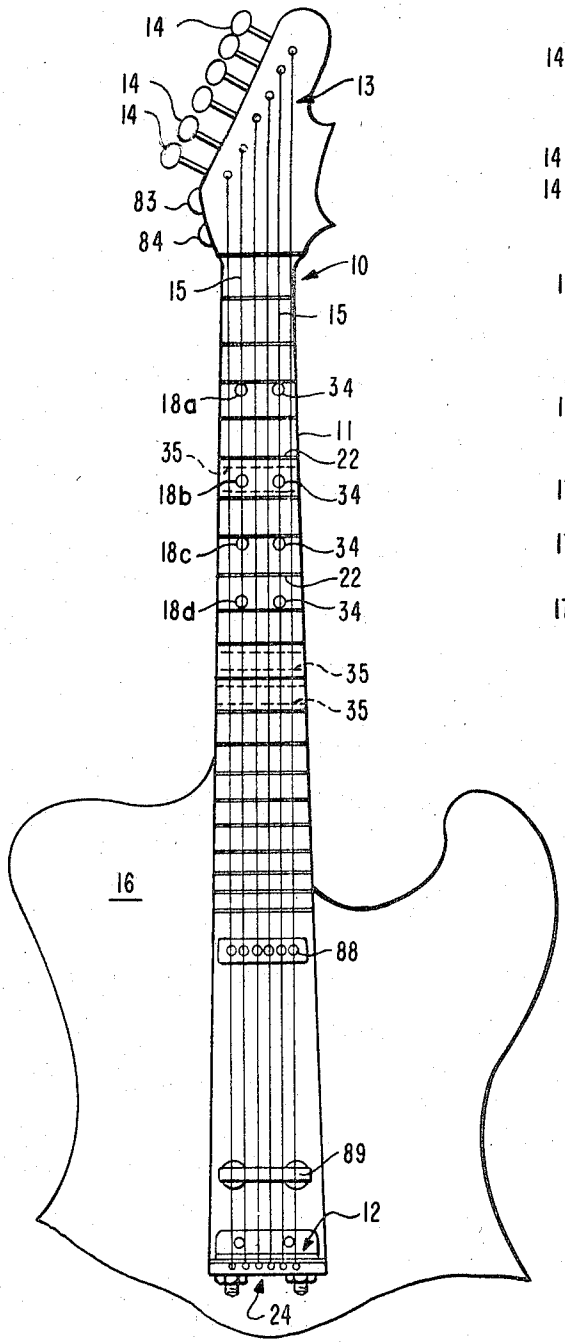


FIG. 2

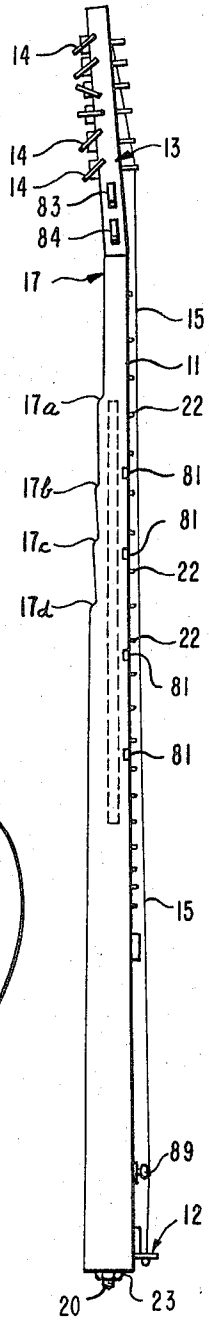
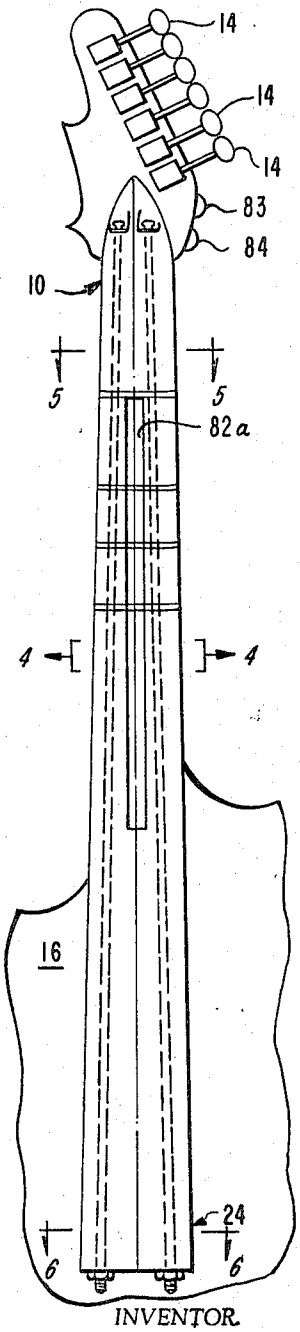


FIG. 3



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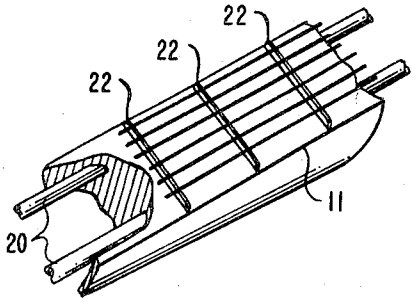


FIG. 4

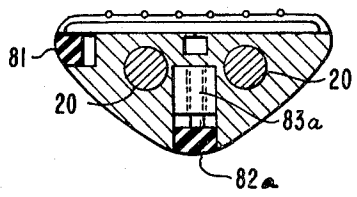


FIG. 5A

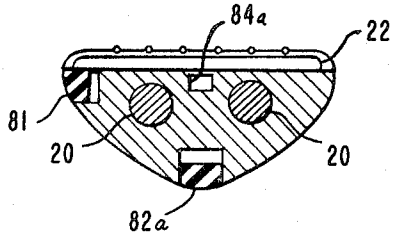


FIG. 5

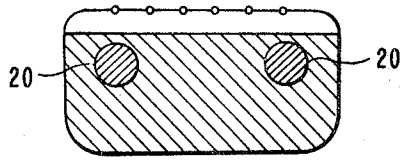


FIG. 6

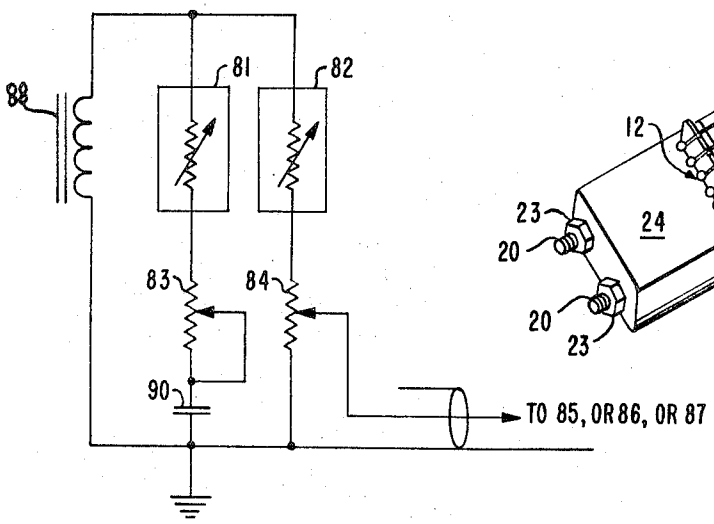


FIG. 8

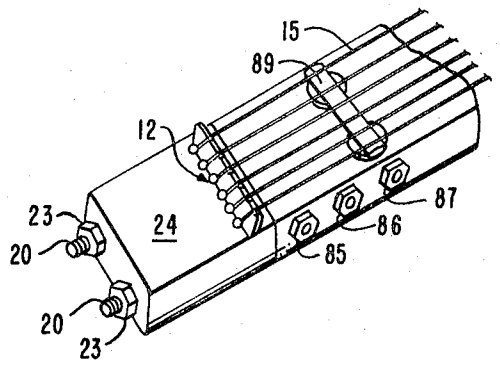


FIG. 7

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3,443,018

GUITARS OR LIKE STRINGED MUSICAL INSTRUMENTS

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Int. Cl. G10d *1/08;* G10h *3/00*
U.S. Cl. 84—1.16 3 Claims

ABSTRACT OF THE DISCLOSURE

Improvements in electrical stringed musical instruments such as guitars are disclosed including a novel torsion bar in the neck with vernier adjustment to stabilize the neck and strings against warpage and twist, conductive rubber tone, vibrato and volume adjustment means and tactile sensing elements in the neck in positional relation to the frets of such nature that an instrumentalist can create a variety of tonal and volume effects, locate specific frets and so forth without it being necessary to look at the fret bar.

This invention relates to stringed musical instruments generally and more particularly to improvements in such stringed musical instruments whereby greater stability in pitch and volume and greater ease in playing is provided for the instrumentalist using said instrument.

Stringed musical instruments of the guitar, mandolin and balalaika variety are generally played by plucking the strings with one hand, either unaided or with a pick, while the fingers of the other hand slide along a fret board and press on the strings to shorten or lengthen the vibrating portions thereof so as to produce different musical pitches therewith. These musical pitches are subject to variation due to the expansion and contraction of the strings or dimensional instability of the fret board which supports the strings. With modern stringed instrument performances requiring a great deal of versatility and a variety of new devices, a great convenience to the artist that does not now exist in such instruments would be a tactile reference by which a particular fret position may be readily found as the artist moves his hand back back and forth on the neck.

In the electric guitar and similar instruments which do not particularly require a sounding board or resonant chamber or body, the string supporting neck or fret board is used almost by itself. The vestigial portion of the instrument, corresponding to the body or sounding chamber used in the nonelectric instrument, is used as an anchor for the strings and a rest for the instrumentalist's forearm while he is playing.

In many prior art electric stringed musical instruments, volume and tone controls for the amplifier circuits used with them have been placed on this vestigial sounding board. These controls are manipulated during the performance with the same hand that is used to pluck the strings.

In this invention the electric stringed instrument is improved by a number of novel instrument components which have been conceived both to make the instrument more stable dimensionally and more easily operated in the manipulative actions accompanying a performance therewith. The instrument incorporating the invention is more versatile.

The artist using an instrument which has been improved as disclosed herein will be able to create more accurate tones in respect to the pitch thereof, a greater variety of novel effects with greater ease of control, and be able to find particular parts of the instrument with less difficulty and greater speed.

One of the improvements contemplated herein is a novel internal skeletal structure for the neck of the guitar. The skeletal structure is embedded therein and includes adjustments such that the dimensional stability of the instrument is much greater. The new neck and fret board is formed or molded in one piece to include the mounting means and tuning keys for the strings. The new skeletal frame elements are in the form of a narrow V-shaped arrangement of truss rods which are inserted or molded into the fret board and which are arranged to have screw adjustments available for outside adjustment of the tension on the rods. The truss rods extend along the length of the neck on the inside thereof. By the use of the truss rod skeletal configuration within the neck dimensional changes due to temperature variations which result in contraction and expansion can be controlled. Twisting and bending in the transverse plane which was common in prior art instruments has been overcome by the use of the truss rods of this invention.

Since the strings are supported on a one-piece neck in this invention, another failing common to prior art instruments has been overcome. This is the result of the greater pitch stability of the single neck construction of this invention. Prior art instruments generally are arranged to have the strings anchored on the body which is separate from the neck and usually adhesively attached thereto. The other ends of the strings are wound about the tuning keys at the opposite end of the neck from the attachment to the sounding cavity or body.

In the present invention the strings being secured at either end of a dimensionally stable single piece neck prevents the kind of variation encountered in the prior art instruments due to the buckling action where the neck is separate, even though adhesively attached to the sounding cavity. The prior art method of attachment is unstable because the neck to cavity contact surfaces are small compared to the length of the neck, resulting in articulation of the neck against the cavity and consequently detuning of the strings during use of the instrument. Frequently also, in the prior art instruments the wood of the neck and that of the cavity or body may be different and may have different coefficients of expansion or contraction leading to the above described tuning instability.

The combination contemplated by this invention provides for a one-piece neck on which the strings are secured at both ends and the tapered internal truss rod supporting skeletal construction thereof and guarantees a uniform stress over the entire length of the string support, eliminating distortion and warp effects. Particularly, this technique overcomes the lateral warp in a transverse plane.

Further new features of the invention include the incorporation on the one-piece neck of all of the control devices which are required for the electronic portions of the amplifying system used in conjunction with the instrument and all of the interconnection jacks by which the electric guitar or other instrument neck is connected with the amplifying system.

In this way the entire neck serves as a complete electric stringed instrument for the artist and provides a novelty act element in which the artists appear to be playing the guitar neck with no apparent source of sound usually associated with the familiar sounding cavity. The sound in such instruments being entirely from the electronic system's loudspeakers.

A still further new feature of the stringed instrument neck of this invention is the incorporation of a series of appropriately positioned marker elements along the rear or palm surface of the neck. These may be either in the form of alternate indentations or projections placed on the back of the neck appropriately related to the fret positions on the front of the neck to provide the instru-

mentalist with a rapidly sensed tactile reference guide to the position of his hand on the fret bar.

An even further improvement over the prior art in the new stringed instrument neck, according to this invention, is the incorporation of a novel resistive rubber gain control element for use in electrical stringed instrument operation. Certain rubber products are available which are subject to changes in their electrical resistance on compression and extension or stretching thereof. When such devices are appropriately dimensioned and installed on the instrument neck of this invention, the instrumentalist can vary volume or tone by pressing his thumb or palm against the compressive rubber resistance element. As contemplated in this invention, the resistive rubber control element extends along the length of the neck so that its use is possible wherever the player's hand may be on the neck during a performance. Various novelty effects such as tremolo, vibrato, and other forms of tonal color may be created by the artist compressing and releasing the compressive rubber resistance element as described above.

The objects of this invention as generally set forth above will be more clearly understood from the specification which follows and the appended claims taken together with the accompanying drawings in which:

FIGURE 1 is a top plan view of a stringed musical instrument neck according to this invention showing a number of the components thereof;

FIGURE 2 is a side elevational view of the neck according to this invention showing a number of components thereof;

FIGURE 3 is a bottom plan view of the invention;

FIGURE 4 is a cutaway partial view of the neck at 4—4 of FIGURE 3, exposing interior details thereof;

FIGURE 5 is a cross-section through 5—5 of FIGURE 3 showing also a variant in FIGURE 5*a* taken through 5*a*—5*a* of FIGURE 1;

FIGURE 6 is a cross-section through 6—6 of FIGURE 3;

FIGURE 7 is a detail of the end of the neck shown in perspective; and

FIGURE 8 is a circuit schematic of the components of the neck.

Referring now to the figures generally wherein the same elements in the different figures are identified by the same reference characters and more particularly to FIGURE 1, it may be seen that in the top view of the electric stringed musical instrument of this invention a neck **10** includes a fret board **11** with a string anchor plate **12** at one end and a string tuning key assembly **13** of conventional design where, by the adjustment of keys **14**, the strings such as **15** attached thereto are stretched or relaxed for tuning.

Neck **10** will ordinarily have no sounding board chamber attached at the string anchor end thereof (see FIGURE 7) but will be assembled to or molded integrally with a rest element **16** shown in broken outline which may be like that shown in my U.S. Design Patent No. 197,143, issued to me Dec. 17, 1963, and entitled "Stringed Electric Musical Instrument," or any other suitable design.

In the side elevation of the invention in FIGURE 2, certain additional details of the neck are shown. For example, there are a series of step-like depressions **17***a*, **17***b*, **17***c*, **17***d* provided on the back surface of neck **10** in positions generally corresponding to the fret guide dots **18***a*, **18***b*, **18***c*, **18***d*, on the front surface of the fret board **11** as may be seen in FIGURE 1. As the instrumentalist is experienced in the playing of an instrument equipped according to this invention with the tactile sensing steps such as **17***a–d*, his proficiency will be increased because he can feel the locations of the fret positions without having to refer visually to the fret guides **18***a–d*.

Another feature of the invention is the imbedded torsion bars or truss rods **20** which are in the form of an elongated and narrow V of a stable metal such as steel. Torsion bars **20** are embedded in neck **10** over the entire length of the assembly **10–11**.

While torsion bars **20** are shown in round cross-section in the figures, it should be obvious to those skilled in the art that many shapes of the bar **20** such as rectangular, hexagonal or others may be used, embedded in neck assembly **10–11**.

From the front surface of neck assembly **10–11** a series of screws **34** are positioned threadedly so as to make contact with torsion bars **20**. These screws **34** may be adjusted to press upon the truss rods or torsion bars **20** so as to align the neck when the strings **15** are under tension to prevent the bowing action which normally would otherwise occur. The result of this improvement is to present a stable dimension between the strings **15** and fret board surface **11** so that the finger attack, when pressing the strings **15** against the frets **22**, may not have to be different at different locations along the fret board **11**. Screws **34** are adjusted from the top and are appropriately spaced to correspond with fret markers so that the decorative fret markers such as **18***a–d* can be placed over the otherwise unsightly screw heads. Mother-of-pearl is the usual decorative material used for these fret markers.

A further advantage of the use of the torsion bars or truss rods **20** imbedded in neck **10** is to reduce and prevent lateral warpage as well as the bowing action previously mentioned. At the anchor end **24** of the neck **10**, rods **20** are threaded to receive nuts **23** which may also be adjusted to produce an appropriate pull on rods **20** to overcome the torsional warp characteristic of prior art stringed instrument necks. This warp is present whether wood or plastic is the material of which the neck is fabricated and is due to differential action of the expansion and contraction factors on the grain of the material of which the neck is made.

When tuning instruments not equipped as in this invention, the settings may not hold without a means for stabilising the dimensions of neck length and warp or bowing thereof. It is such problems that are overcome by the improved neck according to this invention, i.e., by the use of torsion bars or truss rods such as **20**.

Such things as the buzzing of strings which hit frets when the fret bar warps and the pitch changes, due to bowing, are eliminated.

It has been pointed out that the torsion bars **20** are V-shaped. This is emphasized in the several figures, particularly in FIGURES 4–6 where cross-sections through neck **10** are shown. Section **4—4** is taken through the center. Section **5—5** near the tuning key assembly **13** and section **6—6** near the string anchor, **12**. The narrow end of the V is at the key end (**5—5**) and the wide end at the anchor end (**6—6**).

Considering the strings **15** as one foot and the two rods of torsion bar **20** as the other two feet, one may liken the action to that of a tripod which prevents warp due to string pull. The V-shape of torsion bars **20** so embedded in neck **10** as shown in the figures tends further to prevent a lateral warp or twist. This is the particular element which prevents the string buzz mentioned above. The fine adjustment screws **34** are a vernier control adjustment so to speak for the torsion bars **20**.

A further improvement of the fret bar **10–11** according to this invention, is the incorporation of conductive rubber elements **81** and **82** in neck **10**. Conductive rubber elements **81** and **82** as used herein are embedded with carbon in such fashion that the resistance thereof changes with compression and tension thereon. As shown in the circuit of FIGURE 8, the conductive rubber elements **81** and **82** are used for the tone control and volume control "fine adjustment." Coarse adjustment resistances **83** and **84** included in series for a preliminary setting as suits the artist's preference. These are positioned near tuning keys **14**.

The rubber elements for tone adjustments **81** or for

volume adjustment **82** may be embedded along the edge in the side of neck **10** or along or in the back of neck **10** as shown at **82***a* so that the thumb or palm or thumb-forefinger crotch may be used to compress the conductive rubber elements while playing.

The connecting wires from the rubber elements **81** and **82** or **82***a*, are carried through the interior of the neck **10** in channels **83***a* and **84***a* provided therein.

Conductive rubber elements such as **35**, shown in broken line, may also be included between frets so that when the artist presses down on the string at a particular fret, the amplitude of the electrical output of the note may be varied by pressing upon the string more or less strongly. This also compresses the rubber element **35** to achieve such effects as vibrator without the usual pitch waver.

As shown at **82***a* in FIGURE 3, the rubber element may be actuated by a rocker arm in the back of neck **10** for volume or it may be used as a tone control element of the type indicated at **81** in FIGURE 8. When so arranged, pressure upon the rocker arm or bar **81***a* or **82***a* by the palm, or the crotch of the hand between the thumb and forefinger, may be used to actuate the change in resistance necessary to achieve the desired effect. This is usually a left-hand function.

The gross adjustment controls **83** and **84** may be positioned on the neck **10** near the key elements **14** as shown in the figures so that a rapid adjustment may be made during playing by the left thumb or forefinger.

The various improvements described hereinabove for electric stringed musical instruments provide a guitar or other stringed instrument performer with means for expressing a greater variety of effects and thereby exhibiting greater versatility in his entertainment.

Television performances are usually more effective if the artist does not have to look away from the camera to find the fret position. By the novel tactile sensing indentations described hereinabove, or steps on the rear of the neck, he can perform while looking directly at the audience (television camera). In the prior art stringed instruments the fret markers such as cover screws **34** or those at **18***a–d*, were looked at by the performer as he went through his routine. Now he can have a tactile reference of the fret positions by the use of steps **17***a–17d*.

The ability to create tonal and volume variations without removing the hands from the strings is achieved in the stringed instrument of this invention in the novel compressive and conductive rubber resistance elements **81**, **82**, **82***a*, etc., electrically connected for tone and volume adjustment as shown in FIGURE 8, and positioned in the neck so as to be operable by the palm or thumb-forefinger crotch. Furthermore, the resistance elements such as **35** can also be positioned in the fret boards between each pair of frets **22** to permit volume adjustments by pressure leading to a vibrato without pitch waver as previously mentioned, a novel effect not heretofore achieved.

All of the control elements **81**, **82**, etc., and the electric pickups **88** to which they are electrically connected are disposed in the neck **10** so that with this invention an artist has a unitary electric stringed instrument neck operable without removing the hands from the strings during the playing. Tone control, volume control, fret sensing, special vibrato effects, and dimensional stability for more precise pitch control are the new elements in the instrument according to the invention.

The capacitor **90** shown in the circuit of FIGURE 8 may be one or several which can be switched in and out of the circuit so as to permit a variety of tone control effects by the adjustment therewith of resistance elements **81** and **83**.

The stability is achieved by novel torsion bars embedded in the neck, relieving strain and compensating for string tension variation. There is a total absence of stress on the body of the stringed instrument. This permits the dimension of the neck **10–11** from front to back to be quite thin so as to permit greater ease in playing and also to relieve the difficulty now experienced by short-fingered persons playing such instruments.

Whereas in prior art instruments of the type hereinabove described it was necessary to make volume and tone adjustments with the right hand between string plucking actions, with the present invention, all such action is accomplished with the left hand.

The various devices and elements which are shown in the figures on the instrument neck in various positions, can be positioned in other suitable locations by those skilled in the art without departing from the spirit and intent of this invention within the ambit of the appended claims. The invention should not therefore be considered as limited to the configurations showing but that these configurations are merely illustrative of what can be done to implement the invention.

What is claimed as new is:

1. An improved electric stringed musical instrument having a neck and fret bar with a plurality of strings thereon, said strings being anchored at one end of said neck and terminating in adjustment keys at the other end of said neck, the combination therewith of:

a V-shaped torsion bar embedded in said neck and having adjustment means disposed in said neck and in contact with said torsion bar for making vernier tension adjustments therewith upon said torsion bar for stabilizing said neck against warpage and bowing;

conductive rubber resistance elements disposed in said neck and being positioned thereon so as to be compressible with the thumb and finger tips of the same hand to produce tonal effects in the playing of said instruments;

induction pickup means disposed in said neck beneath said strings to sense the vibration thereof and produce corresponding electric impulses;

volume control means and tone control means electrically interconnected with said conductive rubber resistance elements and with said induction pickup means for cooperatively, with said pickup means and said conductive rubber resistance elements, varying the volume and tonal character of the string created electrical impulses so that when amplified by external amplifier connected to said neck means, novel effects are achieved in the artist's performance with said electric stringed musical instrument; and

tactile sensing means disposed on the rear of the neck of said electric stringed musical instrument in correspondence with the fret guides thereof for guidance of the artist in the position of the frets on said neck to permit the performance with said instrument being made without need to look down at the fret board.

2. An electric stringed musical instrument neck having a fret board and a plurality of strings anchored at one end thereof, said strings terminating in an array of tuning keys at thte other end thereof, said neck comprising:

a formed bar for supporting the strings;

frets on said bar;

a V-shaped truss road embedded in said bar longitudinally therethrough, the apex of the V being near the tuning key end of said neck and the open end of said V being near the anchor end of said neck, providing dimensional and form stability to said bar, in length and width;

a plurality of induction pickup devices disposed in said bar beneath said strings;

a plurality of indentations in the back of said neck to provide on the side thtereof opposite said strings a tactile reference for the frets on said bar to guide a player without need for his looking at said frets; and

conductive rubber volume and tone control elements electrically connected with said induction pickup de-

vices and embedded in said neck where pressure thereon with the fingers and thumb will provide tonal and volume variations in the sounds produced by said strings and in the induced signals in said pickup devices corresponding thereto,

thereby to provide more stable and more versatile performance characteristics in said electric stringed musical instrument.

3. A unitary electric stringed musical instrument neck comprising:

skeletal means embedded therein for providing torsional and longitudinal dimensional stability thereof;

pressure responsive means embedded therein for providing resistance variation when pressed by a player's hands;

induction means embedded therein and being responsive to the strings of said instrument to produce electrical signals corresponding to the vibration of the strings;

said pressure responsive means and said induction means being electrically interconnected; and

indentation means in said neck for locating fret positions thereon, said indentation means being located on the rear of said neck;

whereby a performer using said unitary neck may perform thereon more effectively and efficiently without having to remove his hands therefrom during a performance to make volume and tonal adjustments,

other than by increasing or relieving the pressure of his hands upon said pressure responsive means, and without having to look at the instrument for locating the fret positions thereof, so as to be more effective in performances before television cameras.

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U.S. Cl. X.R.

84—1.09, 293, 315