June 30, 1970 J. F. APPLETON 3,518,353

TONE CONTROL FOR STRINGED MUSICAL INSTRUMENTS

Filed May 20, 1968 2 Sheets-Sheet 1

FIG - 1

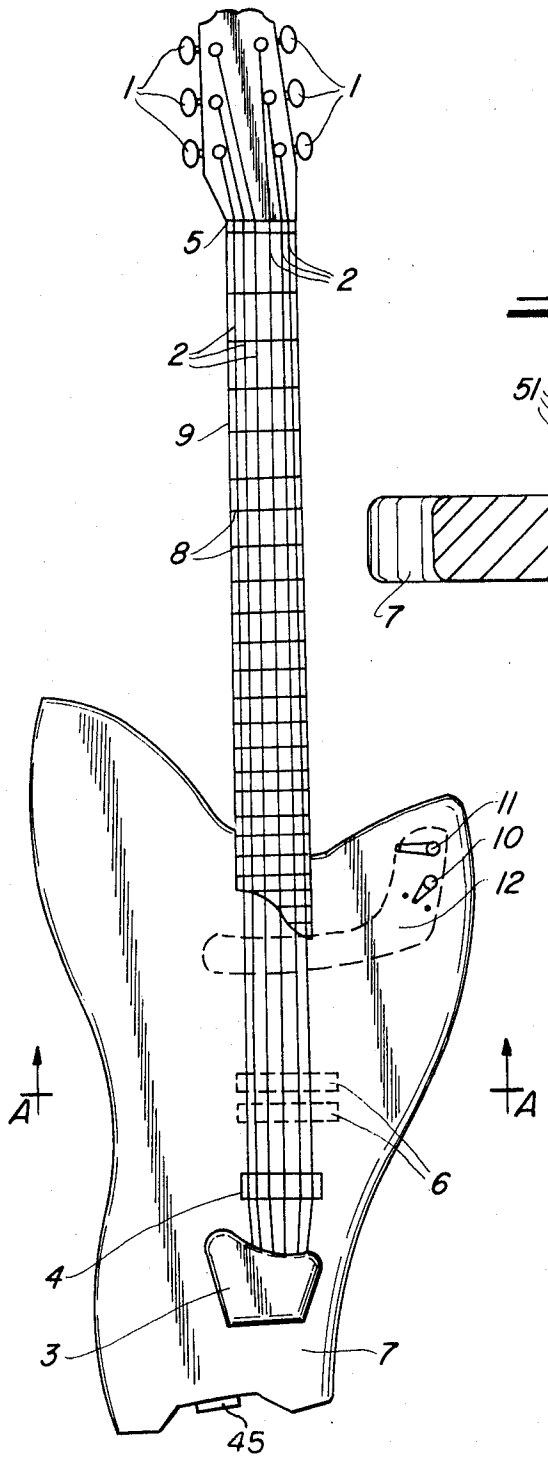
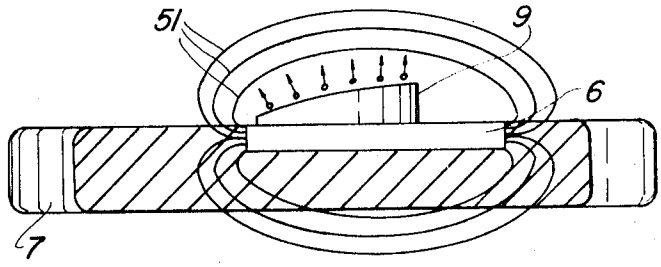


FIG - 2



INVENTOR

JAMIE F. APPLETON

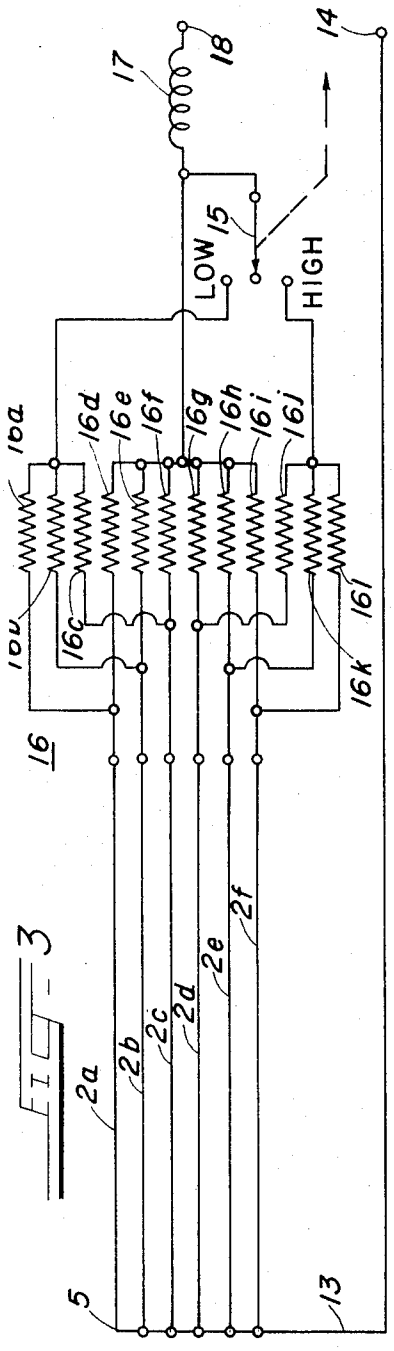
BY Wm T. Hoff

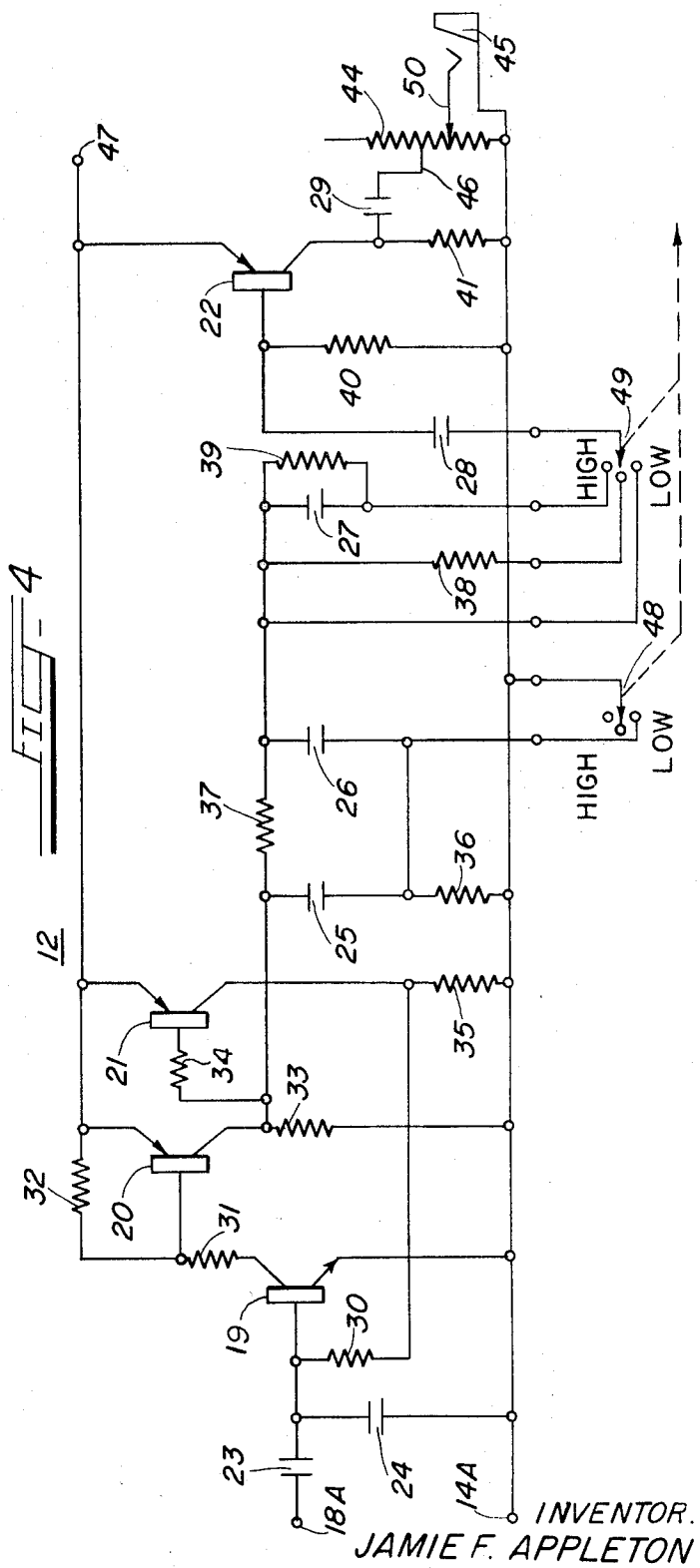
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TONE CONTROL FOR STRINGED MUSICAL INSTRUMENTS

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3,518,353

TONE CONTROL FOR STRINGED MUSICAL INSTRUMENTS

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U.S. Cl. 84—1.15 2 Claims

ABSTRACT OF THE DISCLOSURE

A tone control for stringed musical instruments wherein conductive strings have an alternating current induced in them due to vibrations in a magnetic field and the signals thus created are mixed through a resistive network so as to compensate for distortion and loss of volume in an amplifier when a tone switch is used in the amplifier.

BACKGROUND OF THE INVENTION

Field of the invention

This invention pertains to stringed musical instruments and more particularly to a tone control for stringed musical instruments enabling the sounds made by the strings to be amplified free of distortion by electronic means having a tone switch.

DESCRIPTION OF THE PRIOR ART

Heretofore the connecting of several strings of a stringed instrument in either series or parallel and creating a magnetic field through which the strings may vibrate, thus inducing an alternating current in the strings proportional to the vibrations which may be electronically amplified has been known. In all known applications of this principle, however, the output has been distorted and no provision has been made for varying or controlling the output of the individual strings.

SUMMARY OF THE INVENTION

The tone control for stringed musical instruments herein described provides a conductive system wherein the strings have an alternating current induced in them, and the signals thus created are mixed through a resistive network so as to compensate for distortion of the output of the strings by proper loading of each string played. The resistive network also serves to avoid loss of volume in an amplifier when a tone switch is used.

It is therefore an object of this invention to provide a tone control for stringed musical instruments wherein a portion of the resistive network of the tone control loads the string played to give proper output to an amplifier thus avoiding distortion.

It is a further object of this invention to provide a tone control for stringed musical instruments wherein the filtering of harmonics of the low frequency strings will not reduce the volume of the fundamental tones of the high frequency strings.

It is a further object of this invention to provide a tone control for stringed musical instruments wherein the increasing of relative volume of the harmonics by suppression of low frequencies will not lower the volume of the fundamental tones of the low frequency strings.

It is a further object of this invention to provide a stringed musical instrument which may have a very weak signal generated by the strings moving through a magnetic field and amplify the signal compensating for distortion and tone control.

Further objects and advantages of this invention will become apparent from the following drawings, descriptions and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the preferred instrument, a guitar. FIG. 2 is a sectional view taken on line A—A of FIG. 1. FIG. 3 is a schematic view of the strings of the instrument connected together by a resistive network having a tone control switch. FIG. 4 is a schematic view of a preferred amplifier.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, the guitar shown therein has located thereon tuning pegs **1** stretching strings **2** from tail piece **3** over bridge **4** and nut **5**. The strings **2** are conductive. Permanent magnets **6** are located in body **7** of the guitar. Frets **8** are located on neck **9** of the guitar. Tone control knob **10** and volume control knob **11** are placed on the body **7** near an amplifier **12**.

Referring now to FIG. 3 the strings **2** are connected in parallel by the nut **5**. A common conductor **13** connects the nut end of the strings **2** to output point **14**. Input point **14A** of the amplifier **12** is connected to output point **14**. The tail piece end of the strings **2** are connected to a resistive network **16**. Tone switch **15** has three positions as indicated. The strings **2** in FIG. 3 are treble to bass from string **2***a* through string **2***f*. The resistors **16***a* through **161** of the resistive network **16** have the following suggested values, in ohms reading down from top to bottom: 33, 68, 100, 68, 68, 47, 47, 33, 22, 68, 22 and 10. The radio-frequency choke coil **17** serves as a hum-balancing coil and also a radio-frequency choke to block out strong radio signals. The output point **18** connects to input point **18A** of the amplifier **12**.

Referring now to FIG. 4 a typical amplifier **12** is shown. It is to be understood that the amplifier **12** is not claimed as unique or inventive, but is used to illustrate the connections of the amplifier **12** with the tone switch **15**. The amplifier **12** utilizes four transistors, **19**, **20**, **21** and **22**. These transistors may be of the Amperex type ME 216 for transistor **19** and General Electric type 2N508 for transistors **20**, **21** and **22**. Capacitors **23** through **29** have these values respectively in microfarads; 50, .04, 4, 4, .04, 4 and 15. Resistors **30** through **41** have these values respectively in ohms; 100,000, 2200, 680, 470, 220,000, 4700, 100,000, 330, 11,000, 470,000, 82,000 and 220. A volume control **44** connects the output of the amplifier **12** to the output jack **45**. The volume control **44** is tapped at **46** at 5,000 ohms to give complete range of volume with only 90 degrees of rotation of the volume control knob **11** which is attached to the variable arm **50** of the volume control **44**. A voltage is applied between point **47** and input point **14A** and may be furnished by two-pen-light batteries which will fit in the body **7** of the guitar giving a three volt B+ at point **47**. Output jack **45** is also shown in FIG. 1. The tone switches **48** and **49** of the amplifier **12** are ganged to the tone switch **15** of the resistive network **16**. Contacts of switch **48** are make-before-break, and contacts of switches **49** and **15** are break-before-make.

In the operation of this invention when the strings **2** are plucked they vibrate in the magnetic field **51** of the magnets **6**. Note that the magnets **6** are offset under the strings **2** so that the principal paths of vibrations of the strings **2** as shown by the arrows cut the force lines **51** of the field of the magnets **6** at nearly right angles thus giving maximum signals induced into the strings **2**. The signals thus created in each string **2** are proportionate to the instantaneous velocity of each string **2**. The resistive network **16** composed of resistors **16***a* through **161** will compensate for distortion in the output of the strings **2** in that the resistors **16***d* through **16***i* serve as a load for this output to avoid a very low resistance load of the

strings 2 one to another. For example if the string 2*a* were pluckel a signal would be generated in it and the other five strings, 2*b* through 2*f* without the resistors 16*d* through 16*i* would be an effective short circuit across the output of the string 2*a*. This would weaken and distort the signal produced by plucking string 2*a*. The same would be true of all the other strings 2 without the resistors 16*d* through 16*i* being connected in series with them. The resistances of the strings 2*a* through 2*f* runs from about two ohms for string 2*a* down to .2 ohm for string 2*f*. It is thus noted that the resistors 16*d* through 16*i* present a good sized load to the signal generating capacity of the strings 2.

Further it is to be noted that the resistors 16*d* through 16*i* are approximately proportional to the frequency of the strings 2*a* through 2*f*. The reason for this is that the treble strings 2 vibrate faster than the bass strings 2 to create the fundamental tone of each string 2. The faster the vibration, the more voltage or electro-motive force created in each string. Thus the treble strings 2 would have a louder volume than the bass strings 2 unless the resistances 16*d* through 16*i* were made approximately proportional to the frequency of vibration of the strings 2.

An example of the working of the tone control of this guitar is that if the tone switches 48 and 49 of the amplifier 12 are set on the low position without the resistive network 16 being in the circuit the output of the treble strings 2*a*, 2*b* and 2*c* would be attenuated. The desired result of the tone switches 48 and 49 being on the low position is to filter out the harmonics of the bass strings 2*d*, 2*e* and 2*f*. In order that the filtering of the harmonics of the bass strings 2*d*, 2*e* and 2*f* does not reduce the volume of the fundamental frequencies of the treble strings 2*a*, 2*b* and 2*c*, the resistive network 16 is incorporated. By having the tone switch 15 set on the low position, the resistances 16*a*, 16*b* and 16*c* are connected in parallel with the resistances 16*d*, 16*e* and 16*f* respectively, and to the treble strings 2*a*, 2*b* and 2*c* and the effective resistance in series with the treble strings 2*a*, 2*b* and 2*c* is reduced giving more volume from the fundamental frequencies of the treble strings 2*a*, 2*b* and 2*c*. The values for resistances 16*a*, 16*b* and 16*c* are approximately inversely proportional to the square of the frequency of the strings 2*a*, 2*b* and 2*c* respectively.

When the tone control knob 10 is set on the high position, the result in the amplifier 12 is to increase the relative volume of the harmonics of all six strings 2 by electronically reducing the volume of the lower frequencies. This has the effect of decreasing the volume of the fundamental frequencies of the bass strings 2*d*, 2*e* and 2*f*. By the use of the resistive network 16 the volume of the fundamental notes of the bass strings 2*d*, 2*e* and 2*f* will be increased. The values for the resistances 16*j*, 16*k* and 16*l* are approximately proportional to the square of the frequency of the strings 2*d*, 2*e* and 2*f* respectively. Thus the relative volume of the signal created by each string 2 remains unchanged as the tone control 10 is moved.

It will be noted that the guitar is a self-contained musical production and amplification system which is available to be jacked into any audio-amplifier. Thus any audio-amplifier may be used and the guitar may be played through it giving complete compensation for variations in tone and volume while playing the guitar.

I claim:

1. A stringed musical instrument comprised of a neck and a body, a plurality of conductive strings stretched across the neck and the body, several of the strings being treble strings and several of the strings being bass strings, a resistive network connected to the strings, a first tone switch connected to a portion of the resistive network, the resistive network being comprised of a first resistor connected in series with each string, the string and first resistor series combinations all connected in parallel to an amplifier, a magnet placed near the strings so that vibration of the strings through the field of the magnet creates an electro-motive force in the strings which may be amplified through the amplifier and the value of each first resistor being approximately proportional to the electro-motive force created in each string to which is it connected, a radio-frequency choke connected between the first resistors and the amplifier, a second tone switch in the amplifier, the two tone switches being ganged together, both tone switches having a high position contact, a low position contact, an open position contact and a common contact, the amplifier having an input and an output, the resistive network also having second resistors connected in series with each string at the connection between each string and the first resistor, the second resistors connected to the treble strings being connected together to the low position contact of the first tone switch, the second resistors connected to the bass strings being connected together to the high position contact of the first tone switch, the common contact of the first tone switch being connected to the input of the amplifier through the radio-frequency choke, the second resistors connected to the treble strings and the first tone switch being connected in parallel with the first resistors connected to the treble strings, the second resistors connected to the bass strings and the first tone switch being connected in parallel with the first resistors connected to the bass strings, the second resistors connected to the treble strings being approximately inversely proportional to the square of the electro-motive force created in each treble string, and the second resistors connected to the bass strings being approximately proportional to the square of the electro-motive force created in each treble of the electro-motive force created in each bass string.

2. The stringed musical instrument of claim 1, the radio-frequency choke, the amplifier, the magnet, the volume control, the output jack, the resistive network and the tone switches all being contained in the body.

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HERMAN KARL SAALBACH, Primary Examiner

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U.S. Cl. X.R.

84—1.16, 1.27

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,518,353 Dated June 30, 1970

Inventor(s) Jamie F. Appleton

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 43, cancel the entire line which reads "of the electro-motive force created in each treble".

SIGNED AND
SEALED
OCT 13 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

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