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Stobaugh

[11] **3,709,084**

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[54] **TRANSDUCER VOLUME CONTROL FOR STRINGED MUSICAL INSTRUMENTS**

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[52] **U.S. Cl.**.....**84/1.15,** 84/1.16

[51] **Int. Cl.**.....**G10h 3/00**

[58] **Field of Search**.....84/1.14–1.16, 1.24, 84/1.01

[56] **References Cited**

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1,838,886	12/1931	Tuininga	84/1.15
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[57] **ABSTRACT**

The amplified output of a stringed musical instrument is momentarily reduced by a variable amount during intervals of engagement. Magnetic sensing means detecting such engagement provides a trigger pulse of short duration which is operative through a volume reducing control circuit to vary the output of an amplifier through which sound is fully amplified only during periods when the strings undergo free vibration.

8 Claims, 9 Drawing Figures

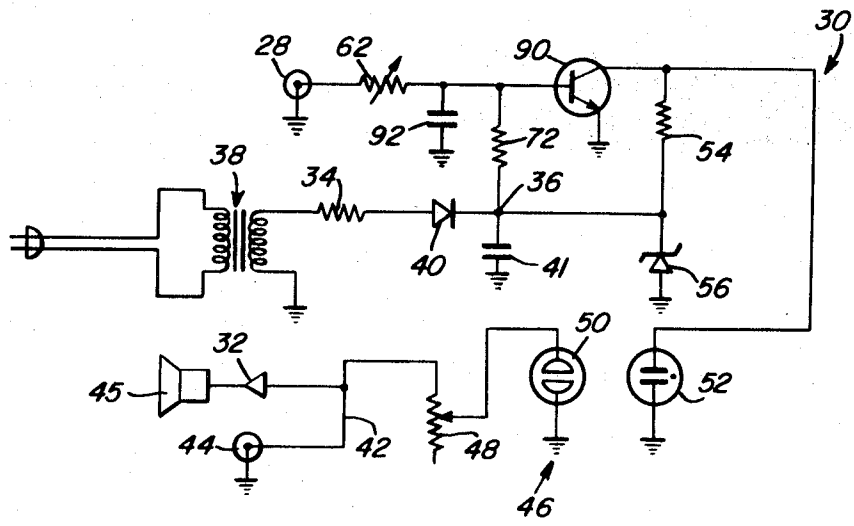


Fig . 1

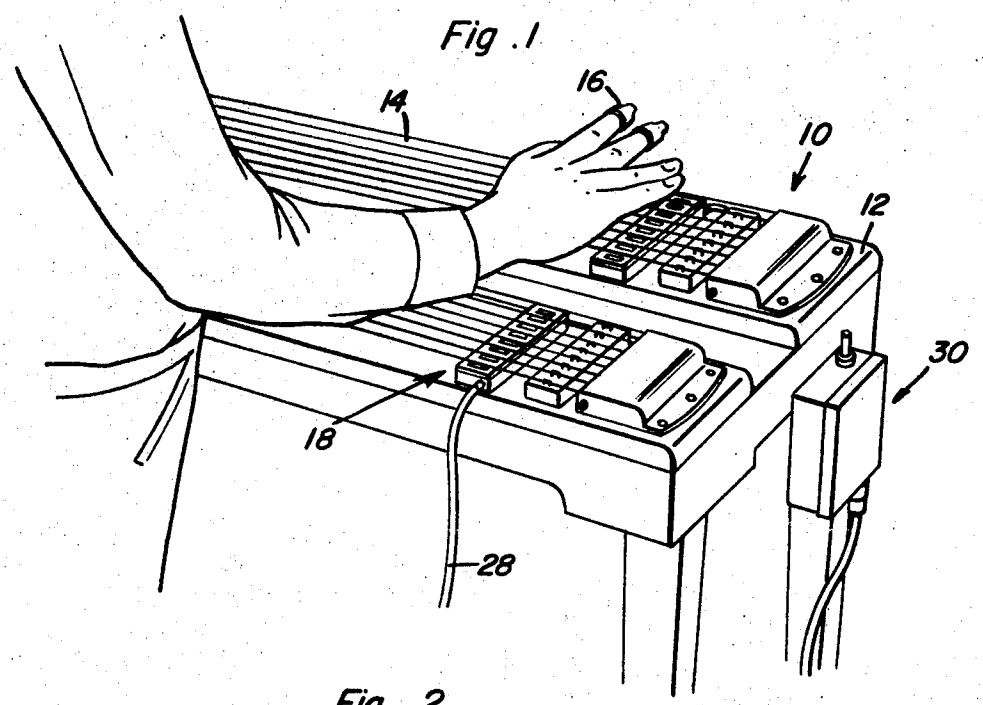


Fig . 2

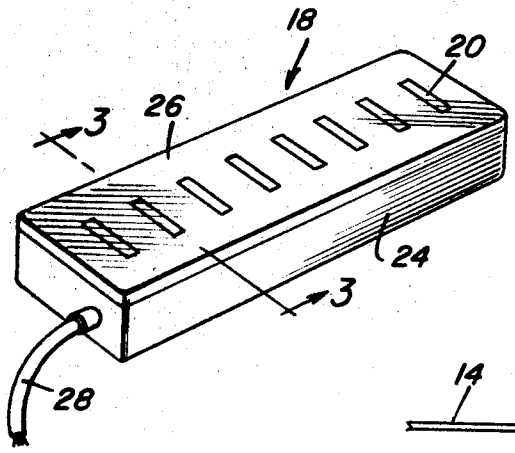


Fig . 3

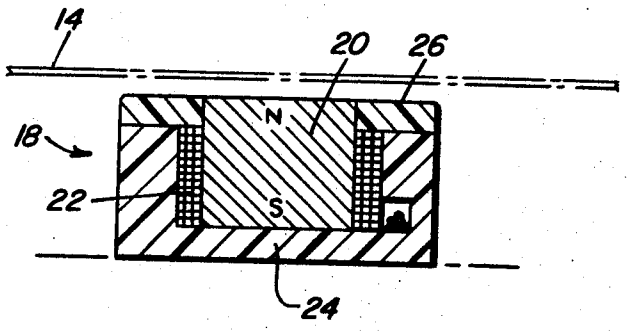


Fig . 4

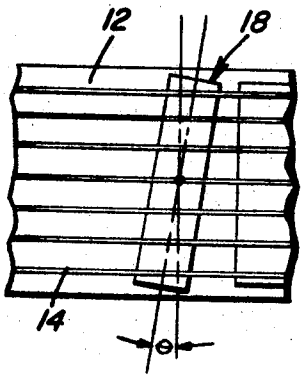


Fig. 5

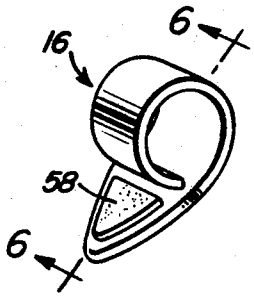


Fig. 6

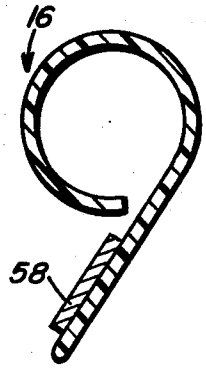


Fig. 7

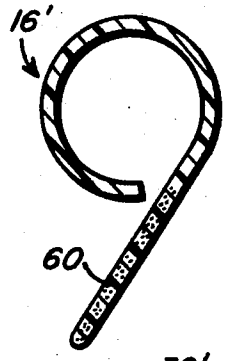


Fig. 8

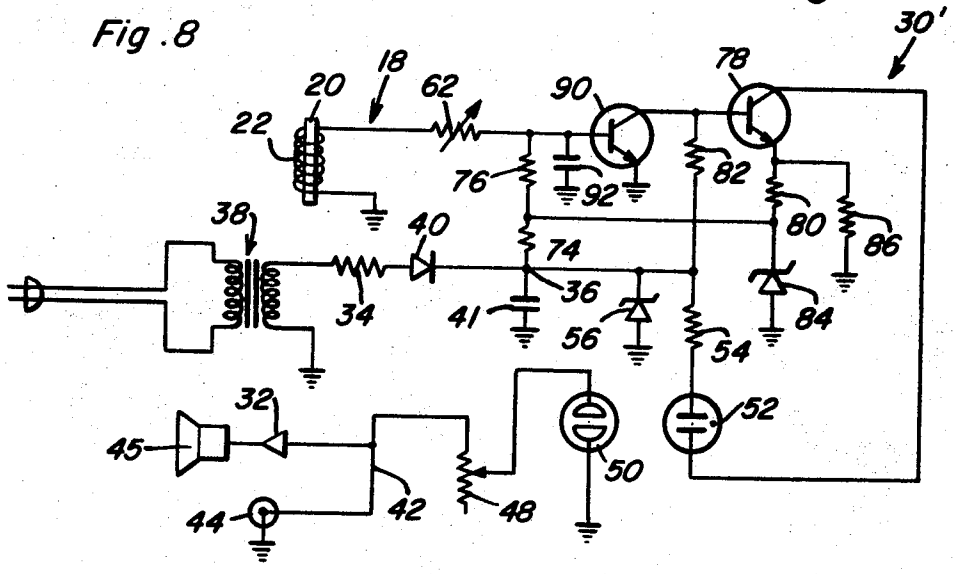
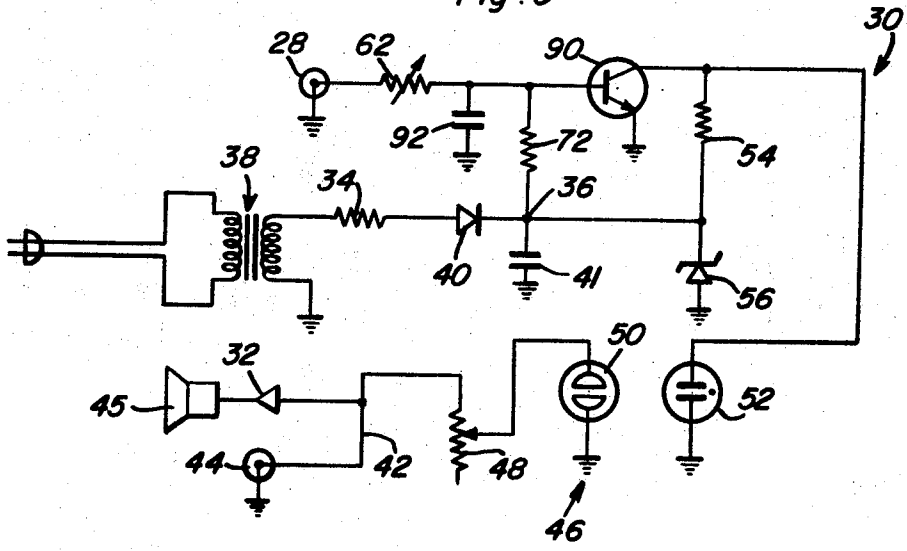


Fig. 9



TRANSDUCER VOLUME CONTROL FOR STRINGED MUSICAL INSTRUMENTS

This invention relates to musical instruments and more particularly to stringed instruments associated with an electronic amplifier such as disclosed in my prior U.S. Pat. No. 3,290,425.

An automatic volume control system is disclosed in my prior U.S. patent aforementioned whereby the amplified output of stringed instruments is reduced during contact intervals between the pick and the instrument strings in order to limit full amplification to periods when the strings undergo free vibration. However, the amount by which the amplification is reduced, is constant. Further, in accordance with the disclosure in my prior U.S. patent, the picks were electrically connected by conductors to the volume control assembly which was of considerable inconvenience to the player.

It is therefore an important object of the present invention to provide an automatic volume control system for the amplifier of a stringed musical instrument operative to momentarily reduce amplification during string engagement by the pick without the use of any electrical conductors extending from the pick. A further object in accordance with the foregoing object is to enable the player of the instrument to vary the amount by which the amplification is reduced. The player is thereby able to control the hardness and volume.

In accordance with the present invention, a magnetic sensor is placed under the strings of the instrument in order to detect contact between the strings and a pick. The magnetic sensor is wired to the control circuit and is operative for the short intervals during which the pick engages a string to produce a negative pulse that momentarily reduces the volume of the amplifier. Further, the amount by which the volume is reduced will vary dependent upon the distance between the magnetic sensor and the location at which engagement is effected between the pick and the string.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a perspective view of a musical instrument utilizing the automatic volume control system of the present invention.

FIG. 2 is a perspective view of one of the magnetic sensors utilized with the instrument.

FIG. 3 is a transverse sectional view taken substantially through a plane indicated by section line 3—3 in FIG. 2.

FIG. 4 is a partial top plan view of the instrument showing the arrangement of the magnetic sensor thereon.

FIG. 5 is a perspective view of a typical pick utilized with the instrument.

FIG. 6 is a sectional view taken substantially through a plane indicated by section 6—6 in FIG. 5.

FIG. 7 is a sectional view showing a modified form of pick that may be utilized.

FIG. 8 is an electrical circuit diagram of the volume control circuit associated with the invention.

FIG. 9 is an electrical circuit diagram illustrating an alternate, simplified version of the circuit shown in FIG. 8.

Referring now to the drawings in detail, FIG. 1 illustrates a musical instrument generally referred to by reference numeral 10 which is in the form of an electric "Hawaiian" guitar having a pair of finger boards 12 which mounts steel strings 14 adapted to be plucked by the player so that the vibrations of the strings produce musical tones. In this type of instrument, the sounds produced by vibration of the strings are amplified by an electronic amplifier and reproduced through a speaker. It should of course be appreciated that the invention may also be applicable to other types of stringed instruments wherein vibration of the strings is induced by engagement therewith with a pick held by the fingers of the player such as the picks 16 shown in FIG. 1.

In accordance with the present invention, two magnetic sensors 18 are positioned below the strings on the two finger boards 12. The sensors are connected through electrical cables 28 to the automatic volume control unit generally referred to by reference numeral 30 adapted to be mounted in any suitable location on the instrument as shown for example in FIG. 1. The control circuit 30 establishes a pickup connection between the stringed instrument and an amplifier in order to drive a speaker. Each of the sensors 18 may be suitably located at an angle θ as shown in FIG. 4 so as to coincide with the playing of the instrument by the player's hand.

Each magnetic sensor 18 as shown in FIGS. 2 and 3, includes a plurality of magnetic cores 20 about which an electromagnetic winding 22 is positioned within a non-magnetic housing 24. One of the polar faces of the magnetic core is exposed through the top 26 underlying one of the strings 14. Thus, when the windings 22 are energized, magnetic fields are established by flux emitted from the exposed pole faces of the magnetic cores 20 through which the steel strings 14 of the instrument extend. The magnetic field associated with each of the strings is affected when the string is engaged by a pick 16 such as shown in FIGS. 5 and 6. The pick 16 as shown may be made of a non-magnetic plastic material with a magnetic material 58 attached such as an element made of powdered iron mixed with a binder. The magnetic element 58 is accordingly affixed to the underside of the pick in order to cut the magnetic flux of the magnetic field associated with a particular string engaged by the pick. Alternatively, a pick 16' as shown in FIG. 7 may be made with magnetic material such as iron powder 16 embedded therein. The polarity of the magnetic cores 20 and the direction of the windings 22 are such that a negative trigger pulse of predetermined frequency is induced in the winding when the magnetic field associated therewith is disturbed or affected by engagement of the overlying string during the short interval when the string is engaged by the pick under control of the player.

Referring now to FIG. 9 which illustrates a simplified version of the control circuit 30, power may be obtained from an available 110 volt source through transformer 38 coupled by a voltage reducing resistor 34 and a voltage rectifying diode 40 to a power supply juncture 36 to which a filter capacitor 41 is also connected. Also associated with the circuit 30, is a signal

input line 42 adapted to be coupled to the instrument through a pickup plug 44. The input line 42 is connected by amplifier 32 to a speaker for reproducing the amplified output of the instrument during free vibration of the strings 14 associated therewith.

In accordance with the present invention, a volume changing control component 46 is connected in parallel with the input line 42 to the amplifier 32. The component 46 includes a potentiometer 48 for regulating the voltage level in the input line above ground. The potentiometer is connected in series with a photoresistive element 50 between ground and the input line 42 so that when the photoresistive element is in a low resistance condition, the setting of the potentiometer will establish the minimum amplification for the signal conducted through the input line 42. The photoresistive element may be in the form of a cadmium sulfide photocell positioned adjacent to a discharge glow device 52 so that when the device 52 illuminates the photocell 50, its resistance is reduced to a low value. The discharge glow device may be in the form of a gas filled neon lamp adapted to be ignited when energized by the voltage supplied thereto through load resistor 54. Voltage regulation is established by the Zenor diode 56 connected to ground between the load resistor 54 and juncture 36 as shown in FIG. 9. Energizing voltage for the glow device 52 is controlled in the magnitude and duration in order to control the momentary reduction in the amplified output in accordance with an input signal supplied to the control circuit from a magnetic sensor 18 connected to the control circuit through the cable 28 as aforementioned. In the embodiment illustrated in FIG. 9, the resistor 54 constitutes the signal transferring means for this purpose.

The signal received from the magnetic sensor in the form of a negative trigger pulse, is processed by a signal generating section of the control circuit to which the sensor is connected by means of an adjustable resistor 62 for controlling the level of the negative input signal. The signal generating section includes a switching transistor 90 having an output collector connected to the glow device 52 in parallel with a grounded emitter through which energizing voltage may be shunted to prevent energization of the glow device 52 when transistor 90 is rendered conductive. Transistor 90 is of the n-p-n type normally held in a conductive state by a positive charge on the grounded capacitor 92 connected to the base, the charge being supplied thereto from the DC potential juncture 36 through base resistor 72. The capacitor 92 is operative to bypass signal currents generated by free vibration of the strings 14, while forced, lower frequency vibrations produced during the string contact interval are passed. It will therefore be apparent, that when a negative trigger pulse is fed through resistor 62 to the base, the transistor 90 is momentarily switched to a non-conductive state thereby permitting the supply of energizing current through resistor 54 at ignition voltage to the glow device 52. The control circuit is thereby operative to rapidly ignite the lamp 52 as well as to cause instantaneous extinction thereof at the end of a contact interval. In this manner, the voltage changing control component 46 is operated only during each contact interval in order to reduce the volume of the amplifier to a value as determined by the brilliance of the lamp 52. The extent to which the lamp 52 is energized will depend upon the magnitude of the trigger pulse supplied by the sensor 18 which in turn depends upon the distance between the sensor and the location at which the associated string is engaged.

FIG. 8 illustrates a control circuit 30' which is generally similar to the control circuit shown in FIG. 9 but is somewhat more reliable and stable in operation by virtue of the addition of certain components. Forward biasing voltage is supplied to the base of the switching transistor 90 through series connected resistors 74 and 76 in lieu of resistor 72 in order to supply a bias voltage from the juncture between the resistors 74 and 76 to the emitter of an amplifier transistor 78 through emitter resistor 80. The output collector of transistor 90 is connected through the transistor 78 to one terminal of the neon lamp 52 in order to maintain the neon lamp extinguished while the transistor 90 is normally conductive. Base bias for the transistor 78 is accordingly supplied through the base resistor 82 in order to maintain transistor 78 non-conductive during conducting periods of the switching transistor 90. For this purpose, the emitter bias for transistor 78 is regulated by the grounded Zenor diode 84 and the grounded resistor 86 directly connected to the emitter. The neon lamp 52 connected at one terminal to the resistor 54 is normally maintained extinguished by the potential applied to its other terminal by the transistor 78 and is rapidly ignited by supply of energizing voltage of ignition value when the transistor 90 is switched off. Since the transistor 78 is connected in series with the lamp 52, a change in its conductivity will control the current conducted through the lamp 52 after it is ignited to regulate the brilliance of the neon lamp for correspondingly varying the degree to which the amplification is reduced during the short intervals of string engagement.

It will also be apparent that each of the electromagnetic windings associated with the magnetic sensor will be energized from the source of DC voltage at juncture 36 in order to establish the magnetic fields through which the strings extend. Cutting of the magnetic flux induces a voltage in the associated magnetic winding in order to produce the negative trigger pulse aforementioned which causes switching of the transistor 90 and ignition of the neon lamp 52 by an amount dependent on the level of the trigger pulse. This accounts for a significant improvement of the performance of the instrument as well as to give the player control over the momentary reduction in volume. This is all accomplished without use of any electrical conductors attached to the pick as in the case of my prior U.S. patent aforementioned.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. In combination with a musical instrument having a string adapted to be vibrated by intermittent engagement during short intervals, an amplifier for increasing

the volume of sound produced by free vibration of the string and volume changing means momentarily reducing the output of the amplifier during said short intervals, the improvement comprising proximity sensing means mounted in spaced adjacency to said string for detecting engagement of the string, signal generating means connected to the sensing means for developing a short duration signal during said intervals and signal transferring means connecting the signal generating means to the volume changing means for varying the output of the amplifier in response to said signal.

2. The combination of claim 1 wherein said sensing means comprises electromagnetic means connected to the signal generating means for establishing a magnetic field through which the string extends.

3. The combination of claim 2 wherein the string is adapted to be engaged by a pick containing a material affecting the magnetic field to induce a trigger voltage in the electromagnetic means.

4. The combination of claim 2 wherein the signal generating means includes a source of voltage connected to the sensing means for operation thereof and switch control means connected to the source of voltage in parallel with the signal transferring means for shunting the same.

5. The combination of claim 1 wherein the signal generating means includes a source of voltage connected to the sensing means for operation thereof and switch control means connected to the source of voltage in parallel with the signal transferring means for shunting the same.

6. The combination of claim 5 wherein said sensing means comprises electromagnetic means connected to the signal generating means for establishing a magnetic field through which the string extends.

7. In combination with a musical instrument having a string adapted to be vibrated by intermittent engagement during short intervals, an amplifier for increasing the volume of sound produced by free vibration of the string and volume changing means momentarily reducing the output of the amplifier during said short intervals, the improvement comprising magnetic sensing means underlying said string for establishing a magnetic field through which the string extends, signal generating means connected to the sensing means for developing a signal limited to said short intervals in response to said intermittent engagement of the string and signal transferring means connecting the signal generating means to the volume changing means for varying the amount by which the output of the amplifier is reduced.

8. The combination of claim 7 wherein the signal generating means includes a source of voltage connected to the sensing means for operation thereof and switch control means connected to the source of voltage in parallel with the signal transferring means for shunting the same in the absence of said signal.

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