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ELECTRONIC TREMOLO UNIT

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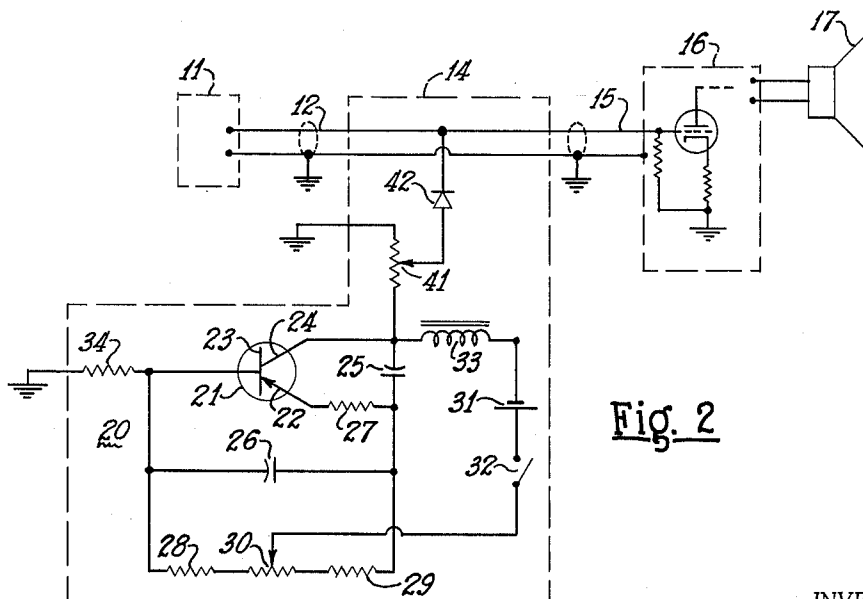
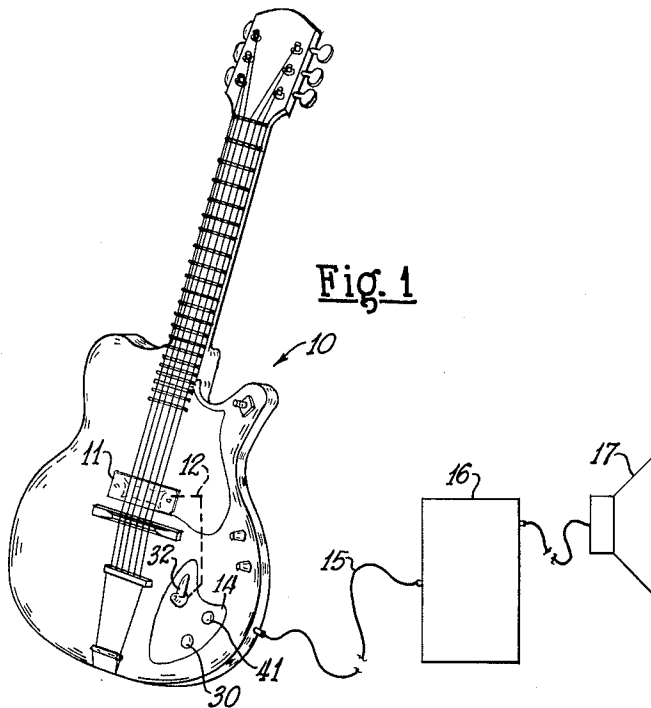


Fig. 2

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ELECTRONIC TREMOLO UNIT

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This invention is related to musical instruments adapted to electronic amplification, and more particularly to an arrangement for electronically inducing tremolo effects in the output of electronically amplified musical instruments.

It is an object of the invention to provide a new, simple, efficient and low cost tremolo or vibrato inducing unit for electronically amplified musical instruments.

It is another object of the invention to provide a simple tremolo producing unit adapted to ready combination with any electronically amplified musical instrument.

It is still another object of the invention to provide a tremolo unit for musical instruments which is small and light in weight to permit its direct physical combination with the musical instruments with which it is to be associated.

Still another object of the invention is to provide a transistorized tremolo unit for electronically amplified musical instruments adapted to compact construction and combination in directly supported relation on musical instruments.

A still further object of the invention is to provide a compact lightweight tremolo signal unit for musical instruments which is adaptable to combination in directly supported relation on the instruments in a convenient location for ready adjustment of the tremolo effect quickly and easily while the musical instrument is in use, and still further, to provide the desired effect without the need for additional apparatus in association with the amplifying equipment.

These objectives are attained according to the present invention in that the unit embodying the circuit providing the desirable features of the invention is adapted to being transistorized and to being combined, rather than inserted in the electronic amplifying equipment associated with musical instruments. Prior art tremolo units in many instances, required modulation of the output signal according to the tremolo frequency, which in turn required that a modulator be incorporated directly in the amplifier equipment itself. By the present invention, however, such cumbersome and inconvenient incorporation of equipment in the amplifier unit is made unnecessary since the invention is based more upon the principle of attenuation by variably shorting, or variably grounding the signal supplied by the pickup unit of the musical instrument at a tremolo rate.

Prior tremolo units have also been known to be based upon varying the gain of an amplifier to modulate the signal being amplified. In the present arrangement, however, the amplifying equipment is allowed to operate in its usual manner without modification, whereas the electrical signal corresponding to the sound of the musical instrument is attenuated at a tremolo rate before introduction into the amplifying equipment. Thus the present tremolo unit, from the standpoint of size, electrical connection, and functional association, lends itself admirably to direct physical combination with the musical instrument itself.

Features of the invention lie in the compactness of the tremolo signal producing unit, which makes it possible, as indicated above, to being mounted entirely on the musical instrument for convenient adjustment of both the depth and frequency of the tremolo signal.

Another feature of the invention lies in its ease of combination with already existing equipment associated with electrically amplified musical instruments.

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A still further feature of the invention lies in its simplicity and adaptability to combination with the music pickup unit with a minimum tendency toward creating distortion in the music to be amplified.

Another feature of the invention lies in its adaptability of combination with musical pickup and amplifying equipment of electrified musical instruments in such a way that it imparts a tremolo effect without distortion for a wide range of frequencies in the output of the musical instrument.

Other objects and features which are believed to be characteristic of my invention are set forth particularly in the appended claims. My invention, however, both in organization and the manner of construction, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawing in which:

FIGURE 1 is a somewhat schematic illustration of a musical instrument showing the general arrangement of electrical amplifying equipment combined therewith for amplification of the output of the instrument; and

FIGURE 2 is a schematic diagram of the electrical circuit for the tremolo signal unit of the present invention.

Although the invention as shown and described herein, is illustrated in combination with a guitar as the musical instrument, it is to be understood that the invention has application to other electrically amplified instruments as well, both stringed and wind blown instruments such as the violin and clarinet, as well as percussion instruments, and instruments in which music is produced by pure electrical oscillating elements. Still further, although specific electronic oscillators are illustrated in the drawings as representative of a low frequency tremolo signal generator, it is to be understood that the specific circuitry for such a low frequency signal is not the basis of the present invention, since any of a number of low frequency tremolo signal generators can be utilized in combination with the elements essential to providing applicant's novel arrangement for imparting tremolo effects in musical instruments.

Referring to the drawing in greater detail, FIGURE 1 shows a guitar 10 having an associated electrical pickup device 11 which supplies an electrical signal corresponding to the string vibrations of the instrument. The signal is fed over shielded conductor 12 to which the tremolo unit 14 mounted on the guitar is connected. The signal is supplied by way of the conductor to the sound amplifier unit 16 from which it is fed to the loud speaker unit 17 for translation into audible mechanical vibrations.

The tremolo unit 14 is connected to the signal lead 12 as shown in FIGURE 2 whereby tremolo effects are imparted to the signal supplied by the pickup 11 prior to being fed to the amplifier 16.

FIGURE 2 shows the circuit details of the tremolo unit 14 wherein the low frequency oscillator 20 is connected to the signal lead of the cable 15 through a semi-conductor diode 42 to effect cyclic attenuation to ground of the signal supplied from the pickup 11. As may be seen, the output signal of the low frequency oscillator 20 is connected to the anode side of a diode 42. This causes the impedance introduced by the diode between the signal supply conductor 12 and ground to vary according to the frequency generated by the oscillator. In other words, the instrument signal supplied over the conductor 12 is attenuated to ground at differing instantaneous amounts determined by the instantaneous amplitude tremolo signal, before the instrument signal reaches the amplifier 16, and accordingly, the output of the amplifier to the speaker 17 is modified at the desired tremolo frequency rate.

The tremolo frequency signal is generated by the oscillator 20 which includes a PNP type transistor corre-

sponding to a triode type tube and having an emitter 22, a base 23, and a collector 24. A pair of capacitors 25 and 26 form a voltage divider for the transistor output, with the capacitor 25 being connected between the collector 24 and the emitter 22 through a resistance 27. The oscillator frequency is determined by the RC feedback circuit formed by resistances connected across the capacitor 26 including balancing resistances 28 and 29 and a potentiometer 30 therebetween. This combination resistance-capacitance circuit formed with the capacitor 26 is connected to the base 23 of the transistor triode and the base 23 is in turn connected to ground through the resistance 34. A source of D.-C. voltage such as a battery 31 is connected into the oscillator circuit through an on-off switch 32 connected to the potentiometer 30.

The magnitude of the resistances and capacitances in combination with the transistor triode are selected to provide a range of frequencies in the order of from 5 to 10 cycles per second. It is to be understood however, that the concept of this invention is not limited to providing a tremolo frequency signal in this range alone. The frequency of oscillation of the oscillator 20 is set by adjustment of the potentiometer 30.

The collector 24 is connected to one end of a potentiometer 41 while the other end of the potentiometer is connected to ground, and the variable voltage tap of the potentiometer 41 is connected to the anode side of the diode 42. The cathode side of the diode 42 is connected to the grid lead of the signal carrying conductor 12. A blocking inductor or choke 33 is connected between the transistor collector 24 and the negative side of the battery 31 to block the tremolo signal from introduction into the battery.

When the tremolo signal is supplied from the oscillator 20, a varying positive voltage is impressed on the anode side of the diode in accordance with the tremolo frequency. This causes the diode to become variably conductive in matched relation to the tremolo frequency, and the instrument signal is accordingly attenuated to ground at such frequency through the low reactance ground-side portion of the potentiometer resistance 41. That is, the conductivity of the semi-conductor diode 42 is varied, and the signal fed over the signal lead 12 is cyclically attenuated to ground, both at a tremolo rate determined by the frequency of the oscillator 20.

The depth of the tremolo effect, that is, the degree of attenuation to ground of the signal transmitted over the conductor 12, is set by adjustment of resistance values at the potentiometer 41. The frequency of the tremolo effect is modified by adjusting the potentiometer 30 which in turn changes the rate of feedback of the signal generated within the oscillator 20.

In its operation, the circuit arrangement of the invention can be considered somewhat analogous to a Zener diode circuit wherein the diode 42, which in effect bridges the conductor 12, establishes the level or magnitude of the signal transmitted over the conductor 12 to the amplifier. The magnitude of the signal transmitted over the conductor 12, however, in this instance, is determined by the signal generated by the oscillator 20. The diode reduces the impedance across the instrument pickup transducer 11, while the impedance of the diode is varied in accordance with the tremolo signal generated by the oscillator 20. Thus, the audio signal generated by the instrument is in effect, shorted or attenuated to ground to varying degrees, or in a sense, is modulated in matched relation to the low frequency oscillator signal.

By way of examples of components which can be incorporated in the circuit arrangement of the invention, a diode which has successfully performed in providing the desired variable conductivity characteristic is a Mallory TX 50, which has a sharp cutoff with a low forward impedance and a high reverse impedance. A transistor which has been found satisfactory in providing the low frequencies desired to be generated by the oscil-

lator 20, is a Texas Instrument Corporation transistor 2N185.

The entire transistorized oscillator circuit and variable directional shorting circuit are readily adaptable to being mounted on a single support member which in turn can be readily mounted on a musical instrument as shown in FIGURE 1. The frequency control adjustment 30 as well as the depth control adjustment 41, and the on-off switch 32, can be conveniently positioned on such support member so that the frequency and depth of the tremolo effect can be changed as desired as the instrument is being played. Since the transistorization of the oscillator makes power requirements extremely low, the battery source for the oscillator 20 can also be mounted on the support member, thereby making the entire tremolo unit a fully integrated unit. The circuit of the unit is such that it can be readily adapted to association with practically any amplified musical instrument with little or no change in the physical structure of the instrument, or in the amplifying equipment associated therewith.

While the above disclosure sets forth a particular form of my invention, it should be understood that I do not wish to be limited specifically thereto, since many modifications may be made within the broad concepts of the invention, and I therefore contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim:

1. A tremolo circuit for electrically amplified musical instruments comprising a musical instrument, means supplying electrical signals corresponding to sound signals generated by said instrument, signal amplifying means electrically connected with said signal supply means, selective directional impedance means connected across said signal supply means so as to normally restrain passage of said signals therethrough, said impedance means being variable in its degree of directionality to variably reduce the restraint of signal passage therethrough, and electrical means for cyclically varying the degree of directionality of said variable impedance means at a tremolo frequency rate to cyclically attenuate the signals supplied to said amplifying means at said tremolo rate.

2. A tremolo circuit for electrically amplified musical instruments comprising a musical instrument, a transducer associated with said instrument supplying electrical signals corresponding to sound signals generated by said instrument, electrical amplifying means for amplification of signals supplied by said transducer, a diode rectifier so connected across said transducer in an electrical direction as to restrain conductivity of said signals therethrough, means for cyclically varying at a tremolo rate the electrical directionality of said rectifier to cyclically vary at said tremolo rate the restraint to conduction of said signals through said rectifier thereby to vary the amplitude of signals supplied to said amplifying means at said tremolo rate.

3. A tremolo circuit for electrically amplified musical instruments comprising a musical instrument, a transducer associated with said instrument supplying electrical signals corresponding to sound signals generated by said instrument, electrical amplifying means electrically connected with said transducer for amplification of said electrical signals, a solid state diode rectifier connected across the output of said pickup transducer with polarity direction such that the diode is normally nonconductive to the flow of said electrical signals therethrough, a low frequency signal generator connected to one side of said transistor diode and arranged to supply low frequency signals to modify the polarity of said one side of the diode to make it conductive to said electrical signal in accordance with the low frequency signal generated, whereby the electrical signals supplied by said transducer to said amplifying equipment are cyclically shorted to varying degrees across said transducer at the frequency of said signal generator.

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4. A circuit for cyclically varying at a relatively low frequency, the amplitude of modulated signals supplied to amplifying equipment comprising a transducer generating such modulated signals, a solid state diode rectifier, said rectifier having a positive terminal and a negative terminal, and being electrically connected across said transducer in an electrical direction as will restrain conduction of said signals therethrough, a relatively low frequency signal supply means electrically connected to one side of said rectifier so as to vary the degree of polarity difference of said one side with respect to the other side at the frequency rate corresponding to the signal of said supply means, thereby to cyclically vary the conductivity of said rectifier to said modulated signals.

5. A portable tremolo unit for electrically amplified musical instruments comprising a base member adaptable to being mounted upon an instrument, a fully integrated transistorized oscillator mounted upon said base member, a semi-conductor diode also mounted upon said base member, means for supplying the signal of said oscillator to one side of said diode, said one side of the diode also being connected to ground through a relatively low impedance, and a lead associated with the other side of said diode for connection to a signal lead of a transducer of an electrically amplified musical instrument.

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6. A tremolo unit as set forth in claim 5 wherein the impedance through which the one side of said diode is connected to ground is adjustable for variation of the depth of the tremolo effect to be produced.

7. A tremolo unit as set forth in claim 5 wherein tremolo frequency and depth controls are provided directly upon said support base member for convenient modification of tremolo effects during playing of the instrument with which said unit is associated.

References Cited by the Examiner

UNITED STATES PATENTS

2,138,500	11/1938	Miessner	84—1.15	X
2,503,352	4/1950	Peters	84—1.25	
2,518,341	8/1950	Libois	332—15	
2,557,888	6/1951	Olson	330—145	X
2,917,717	12/1959	Thorsen	332—52	
3,115,581	12/1963	Kibley	307—88.5	
3,115,601	12/1963	Harris	330—145	X

FOREIGN PATENTS

109,597	2/1940	Australia.
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