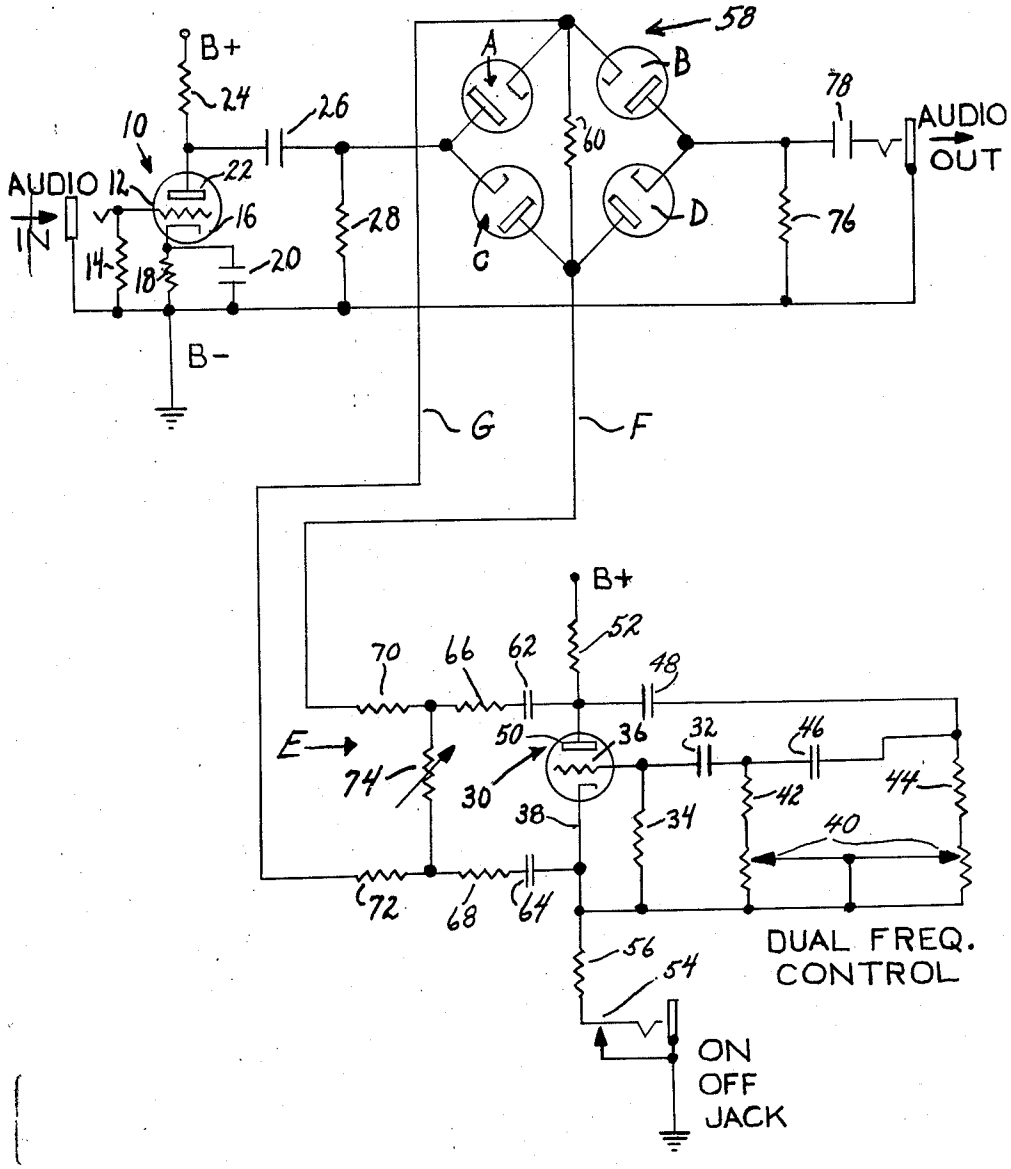
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TREMOLO

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TREMOLO

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1 Claim. (Cl. 179—1)

This invention relates to a tremolo for use with musical devices.

A tremolo effect is often desired for musical instruments and is generally somewhat difficult to obtain. Some devices have been tried, and in many cases introduced distortions and extraneous signals which were of irritating proportions.

It is a prime object of the invention to provide an electronic tremolo which may be utilized with instruments normally connected to electronic amplifier circuits.

It is a further object of the invention to provide an improved tremolo having a variable frequency range.

It is another object of the invention to provide an improved tremolo which is economical to manufacture and positive in action.

In general, the invention comprises an electron tube amplifier to the output whereof is inserted a low frequency wave for modulating a signal passing through the amplifier.

The invention is more fully described in the following specification taken with the figure which is a circuit diagram of an illustrative amplifier and low frequency generator embodying the invention.

Referring to the drawing in detail, an electron tube such as a triode **10** is connected in an electrical circuit to function as an audio amplifier. The triode, for example, may conventionally be a half section of a 12AX7 electron tube or any other single or multi-purpose tube. The circuit as shown, includes an audio-input circuit which is connected to grid **12** across a load resistor **14** which is connected to a grid **12** at one extremity and the other extremity thereof is connected to a reference point as B—. A cathode **16** is connected to the reference point or B— through a bias resistor **18** shunted by a capacitor **20**. Positive potential from the B+ terminal of the power supply is connected to anode **22** through a resistor **24**. This generally completes the circuit of a conventional type audio amplifier, the output whereof is taken from the anode **22** through a capacitor **26** and applied across a load resistor **28**. A low frequency oscillator is formed as a phase shift oscillator and utilizes a second triode **30** which may be the second half of a multi-purpose electron tube such as the 12AX7 heretofore mentioned. The circuitry of the oscillator comprises a grid bias circuit for the phase shift formed by a capacitor **32** and resistor **34** one extremity of each being connected to a grid **36**. The other extremity of resistor **34** is connected to the cathode **38** of tube **30**. Frequency control is accomplished by means of a dual potentiometer **40** the center arm whereof and one extremity of each section are likewise connected to cathode **38**. To provide a frequency range within desired limits a resistor **42** is connected to one of the potentiometer elements and a resistor **44** is connected to the other potentiometer elements. Capacitor **32** is connected to one extremity of resistor **42** and through a capacitor **46** to one extremity of resistor **44** and through a further capacitor **48** to the anode **50** and triode **30**. Anode potential is obtained from a B+ terminal of a source of supply through a resistor **52**, to anode **50**.

The phase shift oscillator is controlled by means of an on-off switch **54** which is in series with a resistor **56** and the cathode **38**, of tube **30**. Output from the oscillator is taken off between cathode **38** and anode **50**. The heart of the invention resides in the modulation of the output signal from the audio-amplifier by the output signal from the low frequency amplifier and is accomplished through a bridge networking **58** formed of four diodes A, B, C, D and having a resistor **60** as a load. The operation of this bridge will be hereafter discussed.

To suitably match the load resistor **60** the oscillator output is coupled through capacitor **62** and **64** to an H pad E formed of resistors **66**, **68**, **70**, **72** and variable resistor **74**. The output signal is taken off load resistor **76** through a capacitor **78**.

In operation the audio-amplifier amplifies a signal which appears across load resistor **28** and is coupled to load resistor **28** and load resistor **76**. On one half cycles output current flows through diode C bridge resistor **60** and diode B and on the other half cycles flows through diode A bridge resistor **60** and diode D. Simultaneously with this flow of current a modulating signal from the low frequency generator obtained from the H pad E is applied across bridge load resistor **60** through wires F and G. In this manner signals appearing across bridge load resistor **60** are affected by the modulating signal obtained from the low frequency oscillator. This modulation results in the tremolo effect.

The phase shift oscillator is balanced for its output facilitating injection to the balanced modulator or bridge network. Balance is accomplished by means of substantially equal value load resistors in the cathode and anode circuit.

Although I have discussed my invention as it is utilized with one type of audio-amplifier and one type of low frequency oscillator, it is obvious that other types of audio-amplifiers, oscillators and other tubes may be utilized with equal results.

In the invention typical values of components utilized with the circuit embodying the invention is herein disclosed as follows:

Resistor **14**	ohms	470K
Resistor **18**	do	1K
Resistor **24**	do	100K
Resistor **28**	do	47K
Resistor **34**	megohms	2.7
Resistor **42**	ohms	100K
Resistor **44**	do	100K
Resistor **52**	do	100K
Resistor **56**	do	100K
Resistor **60**	do	47K
Resistor **66**	do	150K
Resistor **68**	do	150K
Resistor **70**	do	150K
Resistor **72**	do	150K
Resistor **76**	do	47K
Capacitors **20**	mfd	50
Capacitors **26**	mfd	.1
Capacitors **32**	mfd	.01
Capacitors **46**	mfd	.01
Capacitors **48**	mfd	.01
Capacitors **62**	mfd	.5
Capacitors **64**	mfd	.5
Capacitors **78**	mfd	.1
Dual potentiometer **40**	megohms	1
Potentiometer **74**	do	5

Having thus described my invention I desire it understood that variations thereof will be obvious to those

skilled in the art and the claim appended hereto be interpreted within the spirit and scope of the invention.

What is claimed is:

A tremolo including an audio frequency amplifier, a low frequency oscillator, means for adjusting said low frequency oscillator to a predetermined constant frequency and means for mixing a signal passing through said audio amplifier with the predetermined low frequency signal from said low frequency oscillator, said means including a bridge rectifier circuit including a low resistor and means for impressing the predetermined low frequency signal from said low frequency oscillator across said low resistor.

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