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TRANSMISSION CHARACTERISTIC CORRECTION

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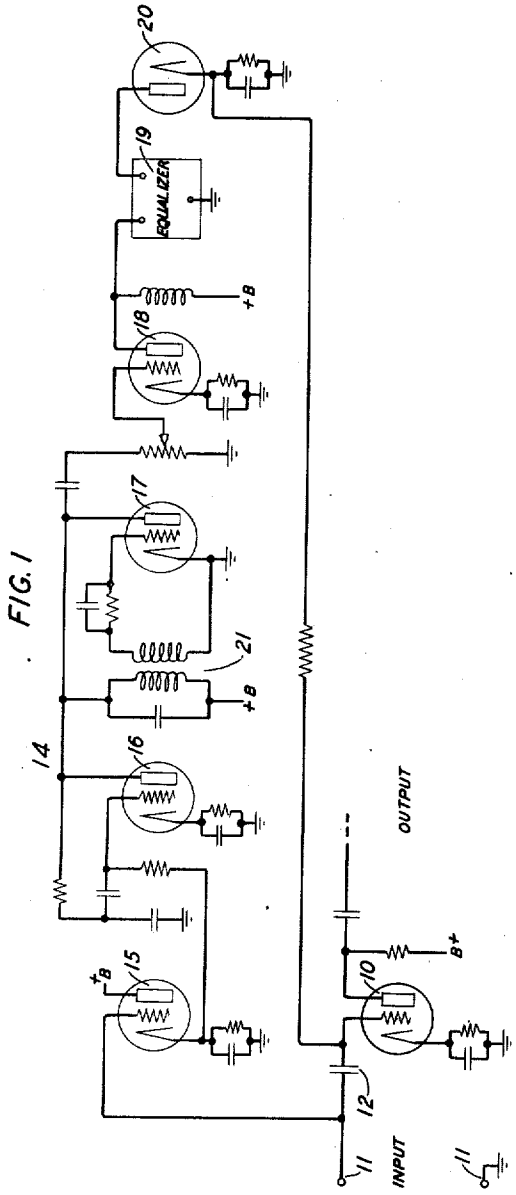


FIG. 1

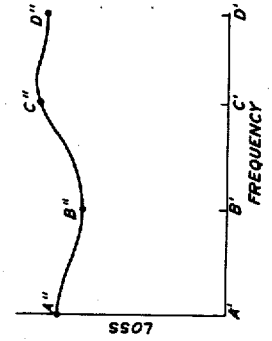


FIG. 4

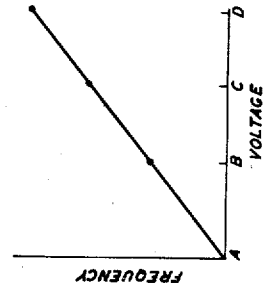


FIG. 3

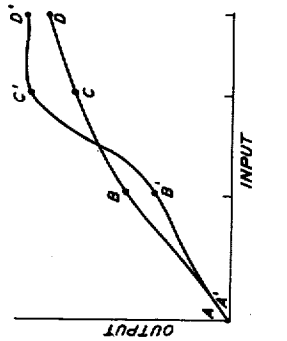


FIG. 2

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TRANSMISSION CHARACTERISTIC CORRECTION

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8 Claims. (Cl. 178—44)

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This invention relates to electric wave transmission circuits and more particularly to the adjustment, correction or compensation of the level transmission characteristic, for example, the voltage input-output characteristic of a circuit.

It not infrequently occurs that the voltage transmission characteristic of a portion of a circuit or system, or of the system as a whole, departs at one or more points or over particular portions from that needed to meet specific transmission requirements. The requisite equalization could be obtained by associating with or including in one or more of the amplifiers of the circuit, suitably designed equalizers or amplifier interstage networks. Such equalizers or networks, however, may be quite complex and difficult to design and construct.

It is an object of this invention to adjust, correct or compensate the level transmission characteristic, for example, the voltage input-output characteristic of an amplifier in a relatively simple manner.

In accordance with a specific embodiment of the invention disclosed herein, the level transmission characteristic of a circuit is adjusted or corrected in preassigned respects by translating a portion of the variable amplitude input to the circuit into direct current potentials, generating under control of said potentials a constant amplitude, variable frequency wave having a linear frequency-control potential characteristic, modifying the generated wave by transmitting it through an equalizer having the required loss-frequency characteristic, translating the modified wave into direct current potentials and impressing the latter on the input of the circuit for gain control action.

A more complete understanding of the invention will be obtained from the detailed description that follows taken in conjunction with the showing of the appended drawing wherein:

Fig. 1 illustrates a circuit arrangement embodying the invention; and

Figs. 2, 3 and 4 show curves to be referred to in explaining the principle of the invention.

With reference to the drawing, the invention is illustrated as applied to the correction or adjustment of the input-output or voltage transmission characteristic of a transmission circuit comprising an amplifier. The amplifier may comprise a vacuum tube or electronic device 10 whose input grid-cathode circuit may be connected to input terminals 11, 11 through a coupling condenser 12, and whose cathode-anode circuit may be resistance-capacity coupled, for example, to a succeeding amplifier stage (not shown), or other circuit components included generally by the designation output. The input to the amplifier may comprise a variable amplitude signal wave. The amplifier may have a voltage input-output characteristic illustrated generally by the

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curve ABCD of Fig. 2. For the purposes of the particular circuit in which the amplifier is included, it may be desired or considered requisite that the input-output characteristic should actually conform to that illustrated by the curve A'B'C'D'. The adjustment or correction required is provided by the control circuit 14 connected across the input to the amplifier.

This control circuit may comprise a detector 15 coupled to a frequency modulater 16 of the well-known reactance tube type for regulating the constant amplitude frequency output of an oscillator 17. The latter is coupled to an amplifier 18 whose output is in turn coupled to an equalizer 19 of suitable loss-frequency characteristic. The equalizer output is connected through a rectifier 20 to the input grid-cathode circuit of the amplifier on the grid side of the coupling condenser 12. The constants of the frequency modulator-oscillator circuit would be chosen so that the output frequency of the oscillator bears a substantially linear relation to the input voltage of the modulator as illustrated by the curve of Fig. 3. The design of the equalizer would be such that the constant amplitude, varying frequency wave input thereto will be attenuated such that the attenuated oscillations vary in amplitude in correspondence to the variation required to be introduced in the normal input-output characteristic of the amplifier, that is, the characteristic per curve ABCD of Fig. 2, in order to modify it to the desired characteristic, that is, the characteristic per curve A'B'C'D' of Fig. 2. Fig. 4 illustrates the loss frequency characteristic that the equalizer would have to enable obtaining the modified characteristic A'B'C'D' of Fig. 2. The points A'', B'', C'', D'' on the curve of Fig. 4 corresponds to points A', B', C', D' on the curve in Fig. 2.

In operation, a portion of the variable amplitude input wave to the amplifier 10 is detected in the detector 15 and translated into direct current potentials corresponding to the instantaneous amplitude of the input wave. These potentials are applied to the grid electrode of the reactance-tube modulator 16 to vary the effective reactance thereof and, consequently, that of the frequency-determining circuit 21 of the oscillator. The oscillations generated by the oscillator will vary substantially linearly with the variations in the input potential to the modulator, and will be of constant amplitude. The output of the oscillator may be amplified to the desired or necessary level by the amplifier stage 18, and then applied to the equalizer to be attenuated in accordance with a loss-frequency characteristic determined by the desired modification in the input-output characteristic under adjustment or correction. The attenuated oscillations are translated by the rectifier into direct current potentials and are applied to the grid-cathode

circuit of the amplifier to adjust the gain of the amplifier in positive or negative direction with variation in the amplitude of the input wave, thereby introducing the correction required to provide the output corresponding to that required in accordance with the desired input-output characteristic.

Although the invention is disclosed with reference to a single embodiment thereof, it will be understood that it is not limited thereto but is of a scope evidenced by the appended claims.

What is claimed is:

1. The method of correcting the input-output characteristic of a circuit that comprises translating a portion of the variable amplitude input to the circuit into control potentials, generating constant amplitude oscillations varying linearly in frequency with respect to said potentials, attenuating the oscillations in accordance with a loss-frequency characteristic related to the desired deviations in the normal input-output characteristic, and translating said attenuated oscillations into control potentials for application to the input of said circuit.

2. The method of correcting the input-output characteristic of a circuit that comprises translating a portion of the variable amplitude input to the circuit into direct current control potentials, generating constant amplitude oscillations varying linearly in frequency with respect to said potentials, attenuating the oscillations in accordance with a loss-frequency characteristic related to the desired deviations in the normal input-output characteristic, and translating said attenuated oscillations into direct current control potentials for application to the input of said circuit for gain control purposes.

3. In combination, a wave transmission circuit having normally a particular input-output characteristic and means to modify said characteristic in desired respects, said means comprising means to derive from the input wave to said circuit potentials corresponding to the varying amplitude of said wave, means responsive to said potentials to generate constant amplitude oscillations varying in frequency linearly with respect to said potentials, means for attenuating said oscillations such that the attenuated oscillations vary in amplitude related to the deviations required to be introduced in the normal input-output characteristic to modify it to the desired characteristic, and means for deriving potentials corresponding to the varying amplitude of said attenuated oscillations and for applying said potentials to the input of said circuit.

4. In combination, a wave transmission circuit having normally a particular input-output characteristic and means to modify said characteristic in desired respect, said means comprising a rectifier for deriving from the input wave to the circuit direct current potentials corresponding to the varying amplitude of said wave, a reactance-tube modulator-oscillator responsive to said potentials to generate a constant amplitude, variable frequency output varying in frequency linearly with respect to said potentials, means for modifying the oscillator output in accordance with a loss-frequency characteristic related to the desired modification in said normal input-output characteristic, and a rectifier for deriving direct current potentials corresponding to the varying amplitude of the modified oscillator output for application to the input of said circuit.

5. In combination, a wave transmission circuit including an amplifier having a particular input-output characteristic and means to correct said characteristic in desired respects, said means comprising means for translating a portion of a variable amplitude wave input to the amplifier into a constant amplitude, variable frequency wave, means for translating said latter wave into a wave varying in amplitude related to the desired correction in said input-output characteristic, and means for converting the amplitude variable frequency wave into direct current potentials for application to the input of said amplifier.

6. In combination, an amplifier having a particular input-output characteristic, an input circuit and an output circuit for said amplifier, a source of variable amplitude electric wave to be applied to said input circuit, and gain control means to vary the gain of the amplifier in response to the wave input thereto to modify said input-output characteristic in preassigned respects, said means comprising a circuit for translating a portion of the wave input to the amplifier into a constant amplitude variable frequency wave, the frequency of which varies with variation in and in direct proportion to the amplitude of the input wave, and means for attenuating said variable frequency wave so that the wave has an amplitude-frequency characteristic corresponding in outline to that of the desired corrected input-output characteristic, and for translating the attenuated wave into potentials for application to the input circuit of the amplifier in a sense to produce gain changes in the amplifier effecting preassigned deviations from the normal input-output characteristic of the amplifier.

7. In combination, an amplifier having a particular input-output characteristic, an input circuit and an output circuit, a source of variable amplitude electric wave to be applied to said input circuit, and gain control means for said amplifier to vary the gain of the latter in response to a function of the input wave to modify said input-output characteristic in preassigned respects, said means comprising means to derive direct current potentials from a portion of the input wave, means responsive to said potentials to generate a constant amplitude, variable frequency wave the frequency of which varies in direct proportion to the magnitude of said potentials, means to vary the amplitude of said variable frequency wave as a function of the gain correction required to modify said input-output characteristic in the desired respects, and means to derive direct current potentials from said variable amplitude, variable frequency wave for application to the input circuit of said amplifier.

8. In combination, a wave transmission circuit having normally a particular input-output characteristic, and means to modify said characteristic in preassigned respects, said means comprising means to derive from the input wave to the circuit direct current potentials corresponding to the varying amplitude of said wave, oscillation generating means responsive to said potentials to generate constant amplitude oscillations varying in frequency linearly with respect to said potentials, means for attenuating the oscillations such that the attenuated oscillations vary in amplitude in correspondence to the desired deviations from said particular input-output characteristic, and means for deriving direct current potentials corresponding to the varying amplitude of said attenuated oscillations and for applying said second-mentioned potentials to the input of said circuit.

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