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AUTOMATIC VOLUME CONTROL PREAMPLIFIER

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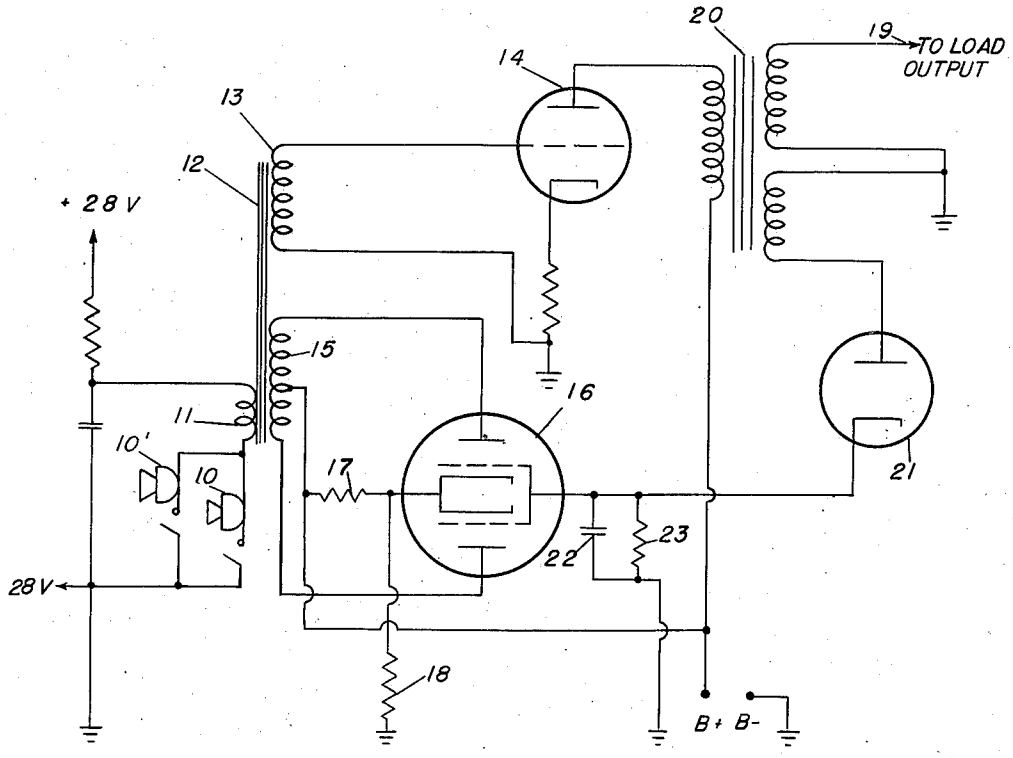


FIG. 2

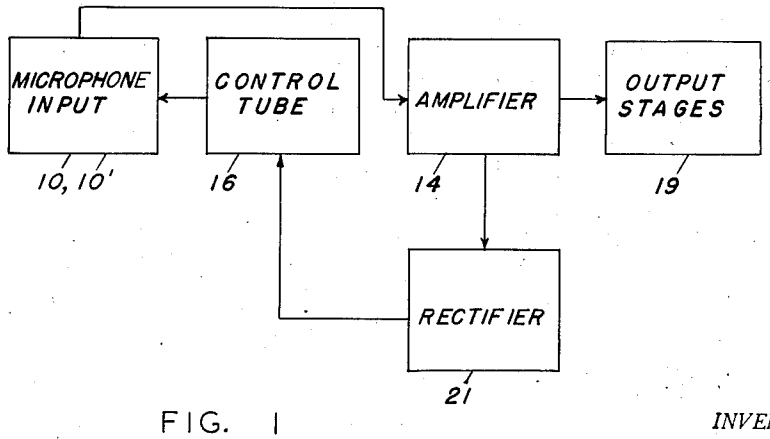


FIG. 1

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AUTOMATIC VOLUME CONTROL PREAMPLIFIER

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2 Claims. (Cl. 179—171)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to automatic preamplifiers, wherein a constant output amplitude level is maintained regardless of the amplitude of the input signal.

Experiment has determined that speech levels vary at high altitudes with different individuals and variation is inherent in mircrophone output with variations of altitude.

It is common knowledge that rarified air at high altitudes conducts sound less readily than at sea level air pressures. Thus the outputs of microphones employed in aircraft interphone systems or to modulate transmitters for transmission of signals to ground stations or to other aircraft, vary in amplitude depending on the altitude of the aircraft in which they are employed. It is likewise a well known fact that individuals' voices become weaker at high altitudes in varying degrees depending on the length of time said individuals have been flying at high altitudes, the amount of oxygen being furnished to them and their general physical conditions. The result of such variations of voice amplitudes in the case of interphone systems is a blasting in the earphones in the case of signals of strong amplitudes or an unintelligible reception because of signals of weak amplitudes.

Accordingly, a novel feature of this invention is the employment of a circuit automatically controlled as to volume in which compromise need not be made in the present level of average modulation so as to accommodate speech levels of different individuals and the output amplitudes of microphones which vary inherently or because of changing altitudes. The present invention automatically levels out the undesirable over-modulation elements and amplifies the overmodulated levels in proportion to the over and under modulation at the source.

Another advantage afforded by this invention is the utilization of an ordinary amplifier tube as the controlling element rather than variable mu tubes. Due to its amplification curve, an inherent characteristic of variable mu tubes which is disadvantageous in interphone systems is that only a small signal variation can be applied to the grids of individual tubes without distorting the amplified output, with the result that more amplifier stages would be required before the signal is applied to the output stage. This invention, by employing an ordinary amplifier tube with its more uniform amplification characteristics will allow an undistorted output over a broad operating range to be applied directly to the output stage.

Employing variable mu amplifier tubes requires

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the use of extensive filtering to eliminate the effects of ripple in the output of the rectifier whereas the circuit of this invention does not require a separate filtering arrangement since the plate circuit of the control tube here employed in effect acts to balance out the effects of ripple.

Applicant, with the knowledge of the effects of variations of individual speech levels at high altitudes, inherent characteristics of and effects of varying altitudes on microphones causing non-uniform reception of audio signals has for an object of his invention the provision of a circuit for automatically compensating for the above factors.

Applicant has as another object of his invention the provision of circuit means responsive to microphone outputs for controllably amplifying said outputs regardless of amplitude.

Applicant has as a further object of his invention the provision of circuit means whereby the amplified microphone output is rectified, and circuit means responsive to said amplified and rectified audio signal for placing a resistive load on the microphone circuit thereby lowering the microphone output to level the amplitude of the strong microphone signals with signals of weaker amplitude.

Other objects and features of novelty will be apparent from the following description and the annexed drawings, it being clearly understood, however, that the invention is not limited in any way by such description and drawings or otherwise than by the appended claims.

In the drawings, in which similar reference numerals refer to like parts,

Fig. 1 is a diagram designating in block form the manner in which the components of this invention are interconnected; and

Fig. 2 is a schematic diagram of this invention.

As previously stated, this circuit provides means for automatically leveling out voice amplitude with variations in altitude and for automatically permitting a decibel gain to replenish the amplitude loss engendered by rise in elevation of an aircraft equipped with an interphone system or wherein a microphone is employed to modulate a transmitter for communication with a ground station or with another aircraft.

The operation of the circuit is as follows: Voice input through microphone 10 or 10' induces a signal voltage in primary winding 11 of high step-up transformer 12 which is inductively coupled through secondary winding 13 to the control grid of amplifier tube 14 and simultaneously through tertiary winding 15 of transformer 12 to the plates of dual triode control tube 16. Control tube 16, however, is normally biased below cut-off by cathode resistors 17 and 18. This bias is chosen to be of any desired value so that changes in plate voltage of tube 16 below

cut-off will have relatively little effect in causing control tube 16 to conduct and affect the amplified output through load line 19.

The amplified output from tube 14 is transformer coupled through transformer 20 to output circuit 19 and simultaneously to the plate of diode rectifier tube 21. The rectified positive voltage from rectifier tube 21 is impressed on the grids of control tube 16 through a time constant network consisting of condenser 22 and resistor 23. The purpose of condenser 22, by quickly charging up and slowly discharging through resistor 23 is to cause control tube 16 to conduct for an appreciable period of time following the first surge of voltage from amplifier tube 14 that exceeds the desired output voltage level. If control tube 16 were to conduct only during the portion of each wave that exceeds the desired output voltage level, then the shape of each such portion of wave would be distorted. When the positive modulating signal voltage on the grids of control tube 16 exceeds the predetermined value of the cut-off bias, tube 16 will conduct, causing a flow of current in the tube circuit proportionate to the amount that the signal voltage exceeds the cut-off bias. This flow of current decreases the plate resistance of tube 16 from a substantially infinite value to a finite value depending on the amount of current flow. Because of the flow of current in the tube circuit comprising coil 15, resistors 17 and 18, and the tube electrodes, these act as a closed circuit and they create a reflected resistance which appears as a load on microphone 10. Since microphone 10 has an internal resistance, this load lowers the voltage potential which will be impressed on coil 13 to the extent of such resistive load. The output of microphone 10 to amplifier 14 is thereby decreased in proportion to the extent of conductance of tube 16. Since condenser 22 and resistor 23 act to retard the rate of return of tube 16 to non-conductance, the output from amplifier 14 to the output network 19 will not be chopped or "clipped" off. Thus, depending on the set values of bias in tube 16, and its resistive and amplification characteristics the output amplitude level of microphones 10 and 10' is automatically maintained within the desired levels.

This invention is described utilizing a carbon microphone as the source of input voltage, however, the invention is likewise applicable with any other signal source connected to primary winding 11. Employing another microphone 10' connected from primary winding 11 to ground would ordinarily lower the amplitude of the signal to the output circuit 19. However, this invention will serve to keep said amplitude at a constant level, as hereinbefore described.

Having thus described my invention, I claim:

1. An automatically controlled preamplifier system for maintaining a constant amplitude output level comprising a source of input signal, a main amplifier for said signal comprising an input circuit, an amplifier tube having at least a grid, cathode and plate; and an output circuit; and a means for controlling the amplitude in said output circuit; said input circuit comprising a transformer having a primary winding connected to said source of signal, a secondary winding connected to the grid circuit of said amplifier tube, and a tertiary winding, said output circuit comprising an output transformer having a primary connected in series in said plate circuit of said amplifier tube, and a secondary winding; said means for controlling the amplitude comprising a rectifier, means coupling said rectifier to the output transformer secondary winding, a control tube having at least a grid, a cathode and a plate, means for normally biasing the control tube grid to cutoff, means connecting the control tube plate and cathode to said tertiary winding, and means connecting the control-tube grid to said rectifier, whereby a portion of said input signal after being amplified will cause the rectifier to unblock said control-tube thereby producing a load current flow in the tertiary winding which reacts on the primary and reduces the signal input to said amplifier, and the amplitude of the output signal.

2. An automatically controlled amplifier system comprising in combination a source of input signals having an internal resistance; a main amplifier for said signal comprising an input circuit, an amplifier tube having at least a grid, cathode and plate, and an output circuit; and means for controlling the signal amplitude in said output circuit; said input circuit comprising a transformer having a primary winding connected to said source of signals, a secondary winding connected to the grid circuit of said amplifier, and a tertiary winding, said output circuit comprising an output circuit comprising an output transformer having a primary in series with the plate circuit of said amplifier, and a secondary winding; said control circuit comprising a rectifier, means coupling said rectifier to said secondary winding of said output transformer, a control tube having at least a grid, a cathode and a plate, means for normally biasing said grid to cutoff, means connecting said tertiary winding in the plate-cathode circuit of said control tube, means connecting the grid of said control tube to said rectifier; and a time constant network intermediate said rectifier and said control tube, whereby a portion of the amplified input signal is rectified to produce a bias-reducing voltage in the grid circuit of said control tube, said voltage causing current to flow in the plate circuit of the control tube during periods when the amplified signal exceeds a level determined by said bias, said current placing a load current across said tertiary winding reflecting a load component of said current into the primary winding of the input transformer which reacts with said internal resistance to reduce the signal input to said amplifier, thereby controlling the signal ouput of said amplifier, said time constant network rendering the control tube conductive for an appreciable number of cycles following the initial surge of voltage from said rectifier to eliminate "clipping" of output signal.

LOUIS N. THEROUX.

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