Aug. 13, 1929. E. I. GREEN 1,724,082

MEANS TO CONTROL CROSS TALK

Filed June 26, 1923

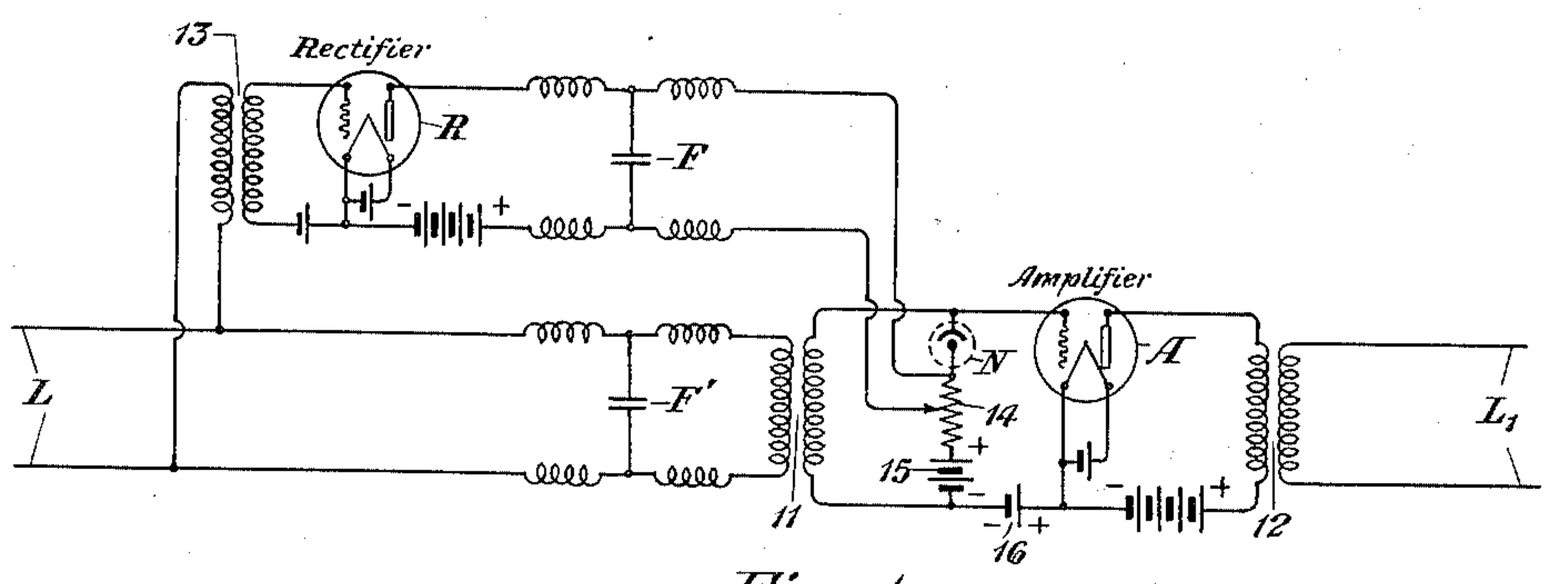

Fig. 1

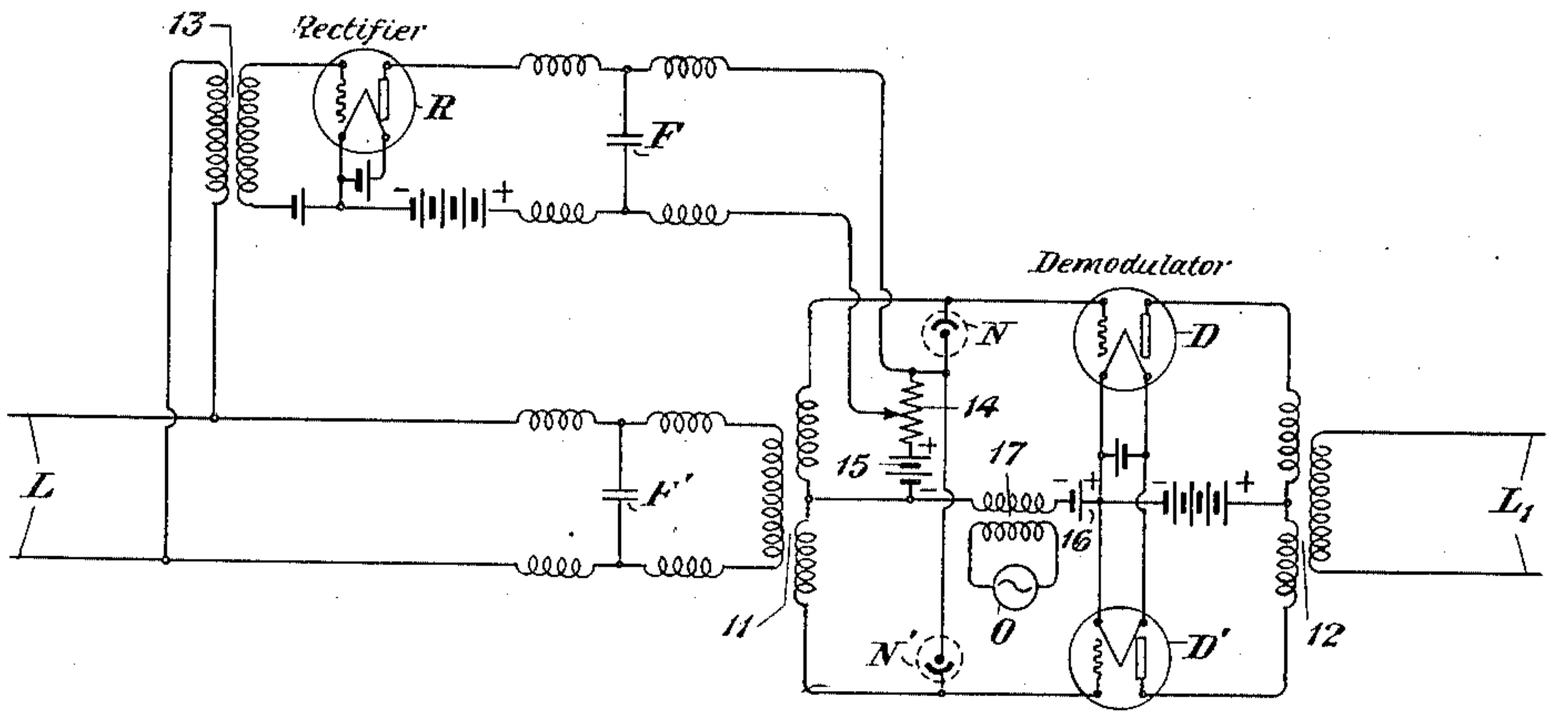

Fig. 2

INVENTOR
E. I. Green

BY

ATTORNEY

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ESTILL I. GREEN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

MEANS TO CONTROL CROSS TALK.

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This invention relates to transmission circuits, and more particularly to arrangements for reducing cross-talk or interference upon such circuits.

In designing telephone transmission circuits with respect to cross-talk limitations, there are two factors to be taken into consideration,—first, the effect of cross-talk upon the intelligibility of the conversation while talking is taking place, and second, the absence of secrecy or the annoying effect of the cross-talk during gaps in the conversation. The latter factor determines the limiting condition, for the reason that the maximum cross-talk current which would be permissible without rendering the conversation unintelligible will be greater than the maximum cross-talk which may be permitted without rendering such cross-talk understandable or objectionable during gaps in the conversation.

It has heretofore been proposed to eliminate or reduce cross-talk or noise currents from external sources during such intervals as conversation is not taking place, by providing switching arrangements for normally disabling the circuit for transmission purposes, such disabling means being removed, however, under the control of voice currents when conversation takes place.

Such a switching arrangement for short-circuiting or opening the circuit during idle periods, in the manner above described, is not, however, entirely practicable for use under all conditions which are encountered in practice. It is therefore proposed, in accordance with the present invention, to arrange the receiving apparatus of the carrier channels so that the receiving gain will be appreciably less at small inputs than at normal speech loads, by providing what is in effect a purely electrical switching arrangement. This results in the receiving apparatus discriminating against cross-talk during non-talking intervals, while permitting of proper transmission of the relatively large talking currents.

The invention may now be more fully understood from the following description, when read in connection with the accompanying drawing, Figure 1 of which shows the invention applied to an amplifier of a receiving circuit, and Fig. 2 of which shows the invention applied to the detecting arrangement of a receiving circuit.

Referring to Fig. 1, an amplifier comprising a vacuum tube A and associated circuits is connected by means of transformers 11 and 12 between circuits L and L_1. The amplifier may be used either as an amplifier of voice currents, or it may be included in one of the receiving channels of a carrier or radio system, in which case the circuit L may extend to apparatus connecting with the main line or antenna upon which the channels are superposed, while the circuit L_1 may extend to the demodulating apparatus associated with the particular channel in question.

In order to control the effectiveness of the amplifier, a by-pass circuit is bridged across the input circuit of the amplifier tube A, said by-pass circuit including a glow discharge tube, such as, for example, a neon tube N, a resistance 14 and a battery 15. The battery 15 is of such voltage and is so poled as to normally break down the resistance of the neon tube and cause a glow discharge to pass so that the neon tube, being conductive, will enable the by-pass circuit to shunt the input of the amplifier and thereby cut down its gain.

In order to control the effectiveness of the by-pass, some of the incoming energy from the circuit L is applied to a rectifier tube R through a transformer 13. The rectifier tube R has its output circuit connected to a resistance 14 in the by-pass, so that when current flows in the output circuit of the rectifier, as the result of applied signal energy, a drop in the resistance 14 is set up in such a direction as to oppose the voltage of the battery 15 and thereby render the glow discharge tube non-conductive. The by-pass thereby becomes in effect open-circuited, so that the amplifier operates at its normal gain.

The usual grid biasing battery 16 is included in the grid circuit of the amplifier, and the voltage of this battery is such as to apply the proper bias to the grid to cause the amplifier to operate most efficiently as an amplifier when the by-pass is in effect open-circuited. The potential of the grid is determined in part by the battery 15 which causes the glow tube to discharge, and in part by the biasing battery 16.

When signals of small energy, such as those corresponding to noise or cross-talk, are being received, the rectified current flowing in the resistance 14 is such as to oppose

the potential of the battery 15 insufficiently to prevent the glow of the discharge tube N, so that the amplifier will be ineffective to transmit such signals. Waves of large amplitude, corresponding to speech, however, as already stated, cause sufficient opposing potential to the battery 15 to in effect open-circuit the by-pass. Thus substantially no input energy will be by-passed through the tube N, so that the system will have maximum gain.

If desired, a filter F may be included in the output of the rectifier to prevent the transmission through the resistance 14 of frequencies normally occurring in the audio frequency band, while permitting the rectified current to change in amplitude with sufficient rapidity so that no appreciable portion of a syllable will be lost when the talker starts to speak. When the filter F is used, with its consequent delay in building up the current in resistance 14, a network F', having an approximately equivalent delay should be included in the circuit L at the point illustrated, to enable the current to be built up in the resistance 14 before the signal wave is actually impressed upon the grid circuit of the amplifier.

Fig. 2 shows the principle above described applied to the demodulator of a receiving channel of a carrier or radio system. The demodulator comprises two vacuum tubes D and D' connected in a push-pull circuit and interconnected between circuits L and L_1 through transformers 11 and 12, respectively. In the usual type of carrier system, the carrier is suppressed at the transmitting station and only the side band transmitted. Consequently, the demodulator at the receiving station has associated with it a source O for supplying alternating current of the carrier frequency, this source being connected to the common branch of the grid circuit through a transformer 17.

A by-pass is connected across the input circuit of the demodulator tube D, the said by-pass comprising a glow discharge tube N, a resistance 14 and a battery 15 for rendering the glow discharge device conductive Similarly, a by-pass is bridged across the input circuit of the tube D', comprising a glow discharge tube N' connected in series with the resistance 14, and battery 15 of the other by-pass, the battery 15 serving, of course, to cause the tube N' to discharge. A biasing battery 16 is also connected in the common branch of the grid circuit to apply such a potential to the grids of the tubes D and D' as will render them effective demodulators when the by-passes are in effect open-circuited.

As in the case of Fig. 1, some of the signaling energy from the circuit L is applied to the rectifier R whose output circuit is connected so as to cause a drop due to the rectified direct current through the resistance 14, this drop being in such a direction as to oppose the potential of the battery 15 and tend to render the glow discharge tubes non-conductive. For weak received currents corresponding to noise or cross-talk, the drop through the resistance 14 is insufficient to interrupt the discharge of the tubes N and N', so that the noise or cross-talk energy applied to the modulator through the transformer 11 is, to a large extent, by-passed and prevented from effectively operating the demodulator to produce audible signal energy in the circuit L_1. When currents of large amplitude, such as those corresponding to voice signals, are received, however, the drop through the resistance 14 is large enough to oppose the potential of the battery 15 to such an extent as to render the tubes N and N' non-conductive so that the by-pass becomes in effect open-circuited and the demodulator supplies to the circuit L_1 a maximum signal current.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated, without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a transmission system, a transmission circuit, receiving apparatus therefor, and means to render the receiving gain of such apparatus appreciably less in response to small received current than in response to currents corresponding to normal signals, said means comprising a conductive shunt bridged across said receiving apparatus, and means controlled by received currents to vary the conductivity of said shunt.

2. In a transmission system, a transmission circuit, receiving apparatus therefor, and means to render the receiving gain of such apparatus appreciably less in response to small received current than in response to currents corresponding to normal signals, said means comprising a normally conductive shunt bridged across said receiving apparatus, and means controlled by received currents to render said shunt less conductive for large received currents than for small received currents.

3. In a transmission system, a transmission circuit, receiving apparatus therefor, and means to render the receiving gain of such apparatus appreciably less in response to small received current than in response to currents corresponding to normal signals, said means comprising a normally conductive shunt bridged across said receiving apparatus, means to produce a direct current whose amplitude is determined by that of the received current, and means to vary the conductivity of said shunt by said direct current.

4. In a transmission system, a transmission circuit, receiving apparatus therefor, and means to render the receiving gain of such apparatus appreciably less in response to small received current than in response to currents corresponding to normal signals, said means comprising a circuit bridged across said receiving apparatus and including a normally conductive glow discharge tube, and means controlled by received current to change the conductivity of said glow discharge tube.

5. In a transmission system, a transmission circuit, receiving apparatus therefor, and means to render the receiving gain of such apparatus appreciably less in response to small received current than in response to currents corresponding to normal signals, said means comprising a circuit bridged across said receiving apparatus and including a normally conductive glow discharge tube, and means controlled by received current to decrease the conductivity of said glow discharge tube as the amplitude of the received current increases.

6. In a transmission system, a transmission circuit, receiving apparatus therefor, and means to render the receiving gain of such apparatus appreciably less in response to small received current than in response to currents corresponding to normal signals, said means comprising a circuit bridged across said receiving apparatus and including a normally conductive glow discharge tube, means to produce a direct current whose amplitude is determined by that of the received current, and means controlled by said direct current to produce a potential in said shunt in such direction as to oppose the conductivity of said glow discharge tube.

In testimony whereof, I have signed my name to this specification this 21st day of June, 1928.

ESTILL I. GREEN.