Nov. 9, 1937. H. A. AFFEL 2,098,329

MAINTENANCE OF PROGRAM TRANSMISSION CIRCUITS

Filed Sept. 24, 1935

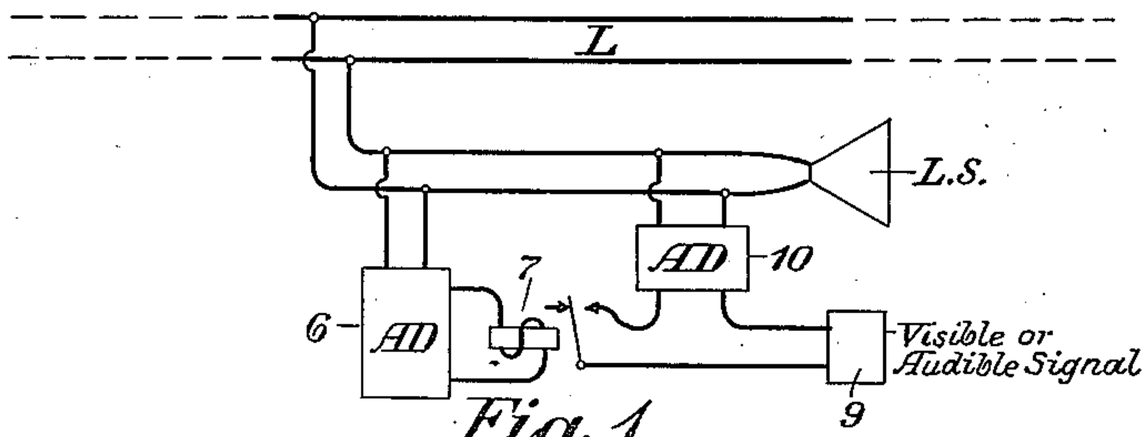

Fig. 1

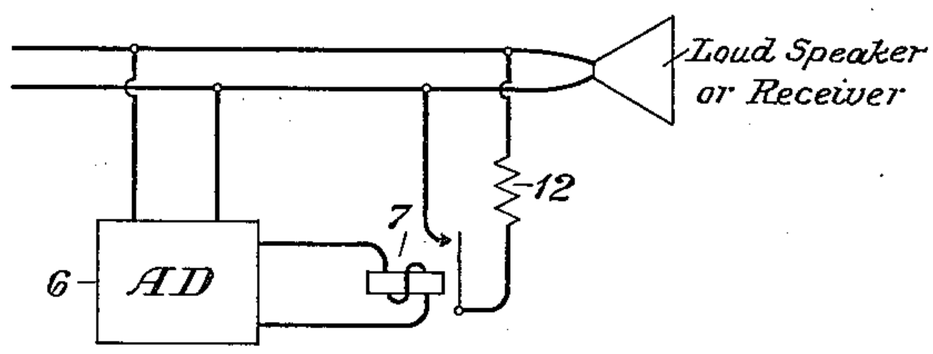

Fig. 2

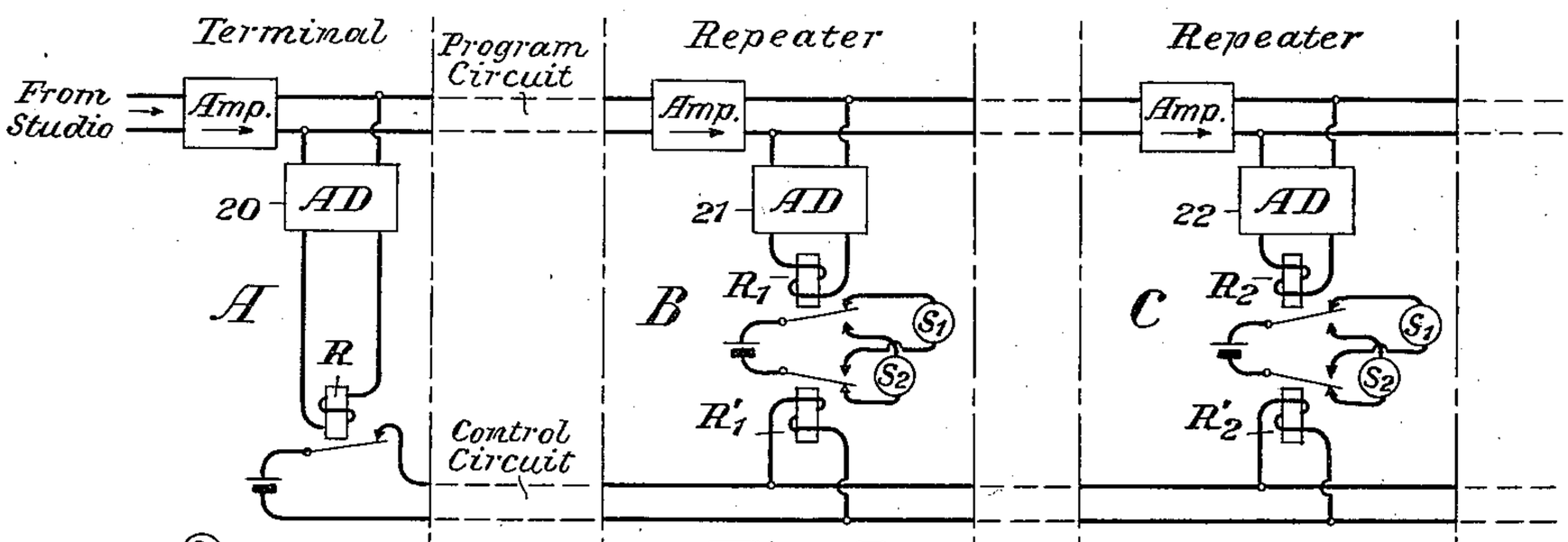

Fig. 3

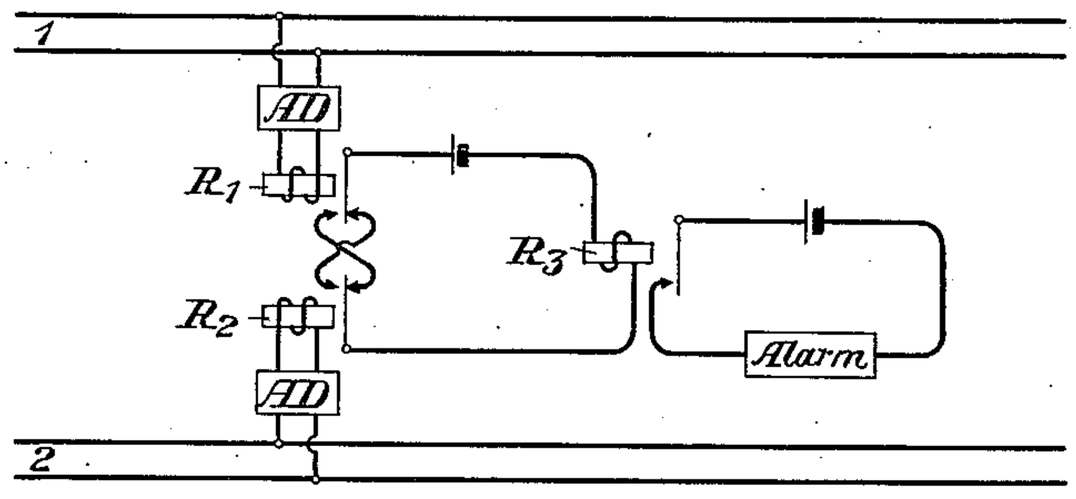

Fig. 4

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Patented Nov. 9, 1937 2,098,329

UNITED STATES PATENT OFFICE

2,098,329

MAINTENANCE OF PROGRAM TRANSMISSION CIRCUITS

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Application September 24, 1935, Serial No. 41,920

13 Claims. (Cl. 179—1.1)

This invention relates to improvements in maintenance of program circuits of the type used in transmitting to various points programs such as are broadcast by radio or otherwise. More specifically, this invention relates to a method and means for monitoring and locating troubles on these program circuits.

The requirements on program transmission, as to quality, continuity of service, freedom from extraordinary noise and freedom from crosstalk, are very severe and considerable effort is spent in measuring and monitoring these circuits. Usually it calls for a more or less continuous listening and monitoring at key points when the circuits are in use. The purpose of this invention is to reduce or avoid the need of such continuous listening or monitoring, thus obtaining greater reliability and effectiveness by relief from the personal element.

Broadly the invention consists in providing certain circuit arrangements which, in the event of abnormal conditions calling for rectification, will automatically give a signal calling attention to the abnormal condition.

The invention will be better understood by reference to the following specification and accompanying drawing, in which Figure 1 shows a simple circuit arrangement carrying out the purposes of my invention; Fig. 2 is a modification of the circuit of Fig. 1; Fig. 3 is a different type of circuit providing signal operation at a plurality of points, and Fig. 4 is still a further modification applicable to two program circuits in parallel.

Referring more specifically to Fig. 1, there is shown a monitoring arrangement which may be attached to a program circuit L by being bridged thereon. In this case monitoring is carried on with an attendant listening to a loud speaker LS, and this may be under conditions in which the room noise is excessive. Part of the monitoring function consists in noting whether the program is being reproduced properly in the loud speaker, but another important part consists in noting the transmission conditions of the program circuit during periods of program silence, having in mind, particularly, such things as the amount of noise present on the line. Under the conditions which exist in actual operation there may be other monitoring loud speakers giving out sound in the vicinity of the loud speaker in question. While there is no great difficulty in listening to the circuit during periods when the program is being transmitted it may be difficult to listen for noise or crosstalk during the quiet intervals in the program. To overcome this effect I arrange in the circuit of Fig. 1 for a supplemental visible or audible signal of relatively high sensitivity which is rendered operative only during periods of program silence. To this end there is bridged across the line in parallel to the loud speaker, an amplifier-detector 6 controlling a relay 7. This relay 7 in turn controls a secondary circuit including a signal device 9 giving either a visible or an audible signal, as preferred. The signal device 9 is responsive, when its circuit is closed, to any sound signals coming over the program circuit through an amplifier or equivalent device bridged across the program circuit. When program is coming in the relay 7 is operated and opens the circuit of the signal device 9. During periods of program silence, however, the relay 7 is released, closing the circuit through amplifier 10 to the signaling device 9. This latter can be adjusted to an appropriate sensitivity to give an alarm or other indication if noise or crosstalk on the program circuit is in excess of a predetermined amount.

A modification of this circuit is shown in Fig. 2 in which the loud speaker is, itself, the signal or alarm device. In this figure an attenuating device, shown here as a resistance element 12, is bridged across the input of the loud speaker. During periods of incoming program the amplifier-detector 6 operates the relay 7 to place the resistance 12 as a shunt across the loud speaker terminals, thus lowering the gain of the circuit, this gain, under these conditions, being such as to give volume of the desired amount in the loud speaker. During periods of program silence, however, the shunt 12 is removed and the gain for the loud speaker is accordingly stepped up very substantially to make it highly responsive to noise or crosstalk on the line, thus enabling it to override the room noise. It is to be understood that there may be a plurality of points on the circuit supplied with the devices of Fig. 1 and Fig. 2.

Fig. 3 shows a further modification of my invention. In this case a plurality of stations A, B, and C at key points of the program circuit are shown, and in parallel to the program circuit there is provided a low grade signaling circuit such as a telegraph circuit which is to be used as a signaling or control circuit. Specifically, there is bridged across the program circuit at the sending end (station A) an amplifier-detector circuit 20. A relay R from the output of this amplifier-detector circuit sends a signal down the control circuit to stations B and C which signal is picked up by other relays at the various key points. In the particular circuit here shown there is a similar amplifier-detector 21, etc., at each monitoring point, these am-

plifier-detectors controlling relays R_1, R_2, etc. Also, at each of these stations there is a relay, referred to above, controlled by the low grade control circuit, these relays being indicated as R_1', R_2', etc. At any one monitoring station the relays such as R_1 and R_1' are interlocked as shown, with secondary signal circuits which may consist of lamps or audible signals, as preferred.

If now speech is applied to the sending end of the program circuit it operates the relay R, thus applying battery to the control circuit which in turn will operate the relays R_1', R_2', etc., but this same program arriving at the monitoring points of stations B, C, etc., will operate the relays R_1, R_2, etc., and thus nothing happens to the secondary signal indicators S_1 or S_2. If, however, during a pause in the program speech or music, relay R is released, thus releasing relay R_1', and if at the same time noise or crosstalk has entered the program circuit in the first section of the line sufficient to operate the amplifier-detector and pull up the relay R_1, then a signal will be given on S_1. On the other hand, if the line noise and crosstalk conditions are satisfactory this signal will not be actuated.

Signal S_2 will be operated in case program is operating the control circuit through relay R, and this speech does not appear at the monitoring point to operate relay R_1. In this case relay R_1 is released thus completing the circuit to signal S_2 and giving an indication of an open line at a point somewhere between the transmitting station and the monitoring point at which the indication is made.

It will be noted that this figure illustrates the use of a D. C. circuit as the control channel. Obviously, many variations may be made in this regard. Such a control channel, for example, might be a carrier circuit or even one of the multiple circuits of a rapid-acting distributor which could be used to distribute signals for several paralleling program controls. Again it is evident that the signals at the repeater may be relayed to a central point such as the receiving terminal. Also, the control circuit may be operated either open circuit or closed circuit. If operated as a closed circuit, as shown, it should preferably be carried over a different pair of wires from the program circuit.

Fig. 4 is an arrangement having general features analogous to that of Fig. 3, but is particularly applicable in the case of two paralleling program circuits transmitting the two channels of an acoustical perspective system. In this arrangement one channel, in a sense, serves as the signal channel for the other. At a repeater or other key point, of which only one is shown in Fig. 4, each of the two paralleling circuits is bridged with an amplifier-detector circuit controlling relays R_1 and R_2, which relays are interlocked to control a secondary circuit containing relay R_3, and a suitable alarm circuit. If the two paralleling circuits are functioning properly the two sets of relays will respond similarly, except in so far as the music being picked up may have a slightly different character qualitatively. In any event, it is expected that the two relays would be operated and released substantially simultaneously when the circuits are in proper condition. If, however, a break should occur in circuit I during a period of music transmission, relay R_1 would be released and relay R_2 drawn up, thus completing the circuit through the secondary relay R_3 which then would operate the alarm circuit. Relay R_3 should preferably be somewhat sluggish in operation because of slight differences in synchronism in the operation of relays R_1 and R_2.

Similarly, if during a quiet interval in the music, circuit I should pick up noise sufficient to pull up the armature of relay R_1 the relay R_2 would be unaffected and an alarm signal would also be transmitted. Of course, if both the paralleling circuits are similarly affected by noise, or if they both suffer an interruption simultaneously, no alarm would be given, but the chance of this occurring is not large. Furthermore, it is to be understood that at such a listening point there would ordinarily be a loud speaker bridged across at least one of the lines.

Obviously many variations may be introduced without departing from the spirit of this invention. For example, the low grade control circuit of Fig. 3 could be used in connection with the two parallel program circuits of Fig. 4. Also, it is evident that in the event of a plurality of monitoring points, such as contemplated in connection with Figs. 3 and 4, the signals or alarms may be confined to these monitoring points or may be transmitted by any suitable signaling channels to some central point for a general supervision. Or, again, annunciator arrangements might be provided at each monitoring point which would receive signals from each of the other monitoring points all directed to the end of carrying out the purposes of this invention, as previously stated.

What is claimed is:

1. In a program transmission line, means for monitoring the line comprising a signal responsive device bridged across the line and responsive to line signals, a secondary circuit, and an electrically operated relay so controlled by said responsive device as to cause said secondary signal circuit to be operated during periods of program silence on the transmission line.

2. In a transmission line, means for monitoring the line comprising an amplifier-detector bridged across the line and responsive to line signals, a secondary signal circuit, and an electrically operated relay so controlled by said amplifier-detector as to produce in connection with said secondary signal circuit a signal indicating the presence of excessive disturbance during periods of program silence.

3. In a transmission circuit, a loud speaker therefor, and a resistance shunt across its terminals, an amplifier-detector bridged across the transmission circuit, and a relay controlled thereby adapted to remove the shunt when no program is present to render the loud speaker more sensitive to circuit disturbances.

4. In a program transmission line system, an amplifier-detector bridged across the line at each of a plurality of points, and secondary circuits controlled by each of said amplifier-detectors to give a signal during periods of program silence to indicate abnormal conditions on the line.

5. In a transmission line system, an amplifier-detector bridged across the line at each of a plurality of points, and secondary circuits controlled by each of said amplifier-detectors to give a signal to indicate a break in the line or the condition of excessive noise on the line.

6. In a program transmission system, a high grade transmission circuit for program, a relay circuit bridged across the line at each of a plurality of widely separated points, a low grade signal circuit or channel parallel to the transmission circuit, relays associated with the second circuit

at each point of a relay on the first line, and signal devices at each of said points controlled jointly by the two relays at that point to indicate abnormal conditions in the line.

7. The combination of claim 6 characterized by the fact that one of the amplifier-detector relays is near the program source and opens the second line during periods of program silence so that none of the subsequent relays on that line is operated.

8. The combination of claim 6 characterized by the fact that there are two signal devices at the said points, one of which is operated in case of a break in the transmission line and the other in case of excessive noise in the preceding section of the line.

9. In a program transmission system adapted for acoustical perspective and comprising two similar parallel transmission circuits, two relays at a monitoring point, one associated with each transmission line, and a secondary indicating circuit so controlled by the two relays that no indication is given when the program is present or absent on both lines and an indication is given when the program is absent from one line.

10. In a program transmission system adapted for acoustical perspective and comprising two similar parallel transmission circuits, two relays at a monitoring point, one associated with each transmission line, and a secondary indicating circuit so controlled by the two relays that no indication is given when the program is present or absent on both lines and gives an indication when program is absent from one line or when there is excessive noise on one of the lines.

11. In a program transmission system adapted for acoustical perspective and comprising two similar parallel transmission circuits, derived circuits from each of these transmission circuits at a monitoring point, a secondary signaling circuit at said monitoring point, the derived circuits so controlling the secondary signal circuit as to indicate substantial difference in the condition of the two transmission lines.

12. In a program transmission line, means for monitoring the line comprising a signal responsive device associated with the line and responsive to line signals, a secondary signal circuit, and electrically operated means so controlled by said responsive device as to cause said signal circuit to be operated during periods of program silence on the transmission line.

13. In a transmission line, means for monitoring the line comprising a rectifier bridged across the line and responsive to line signals, a secondary signal circuit including a signaling element, and electrically operated means so controlled by said rectifier as to operate the signaling element at said secondary circuit during periods of program silence, to indicate presence of excessive disturbance.

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