

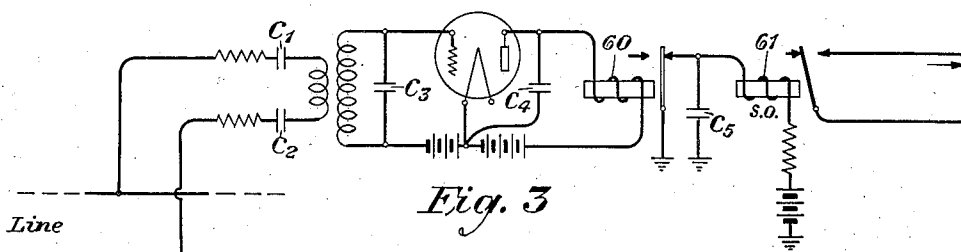
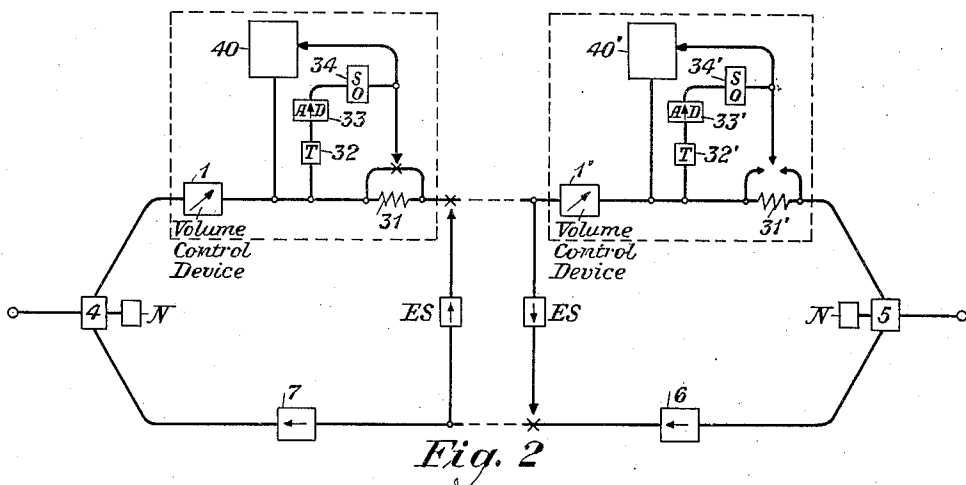
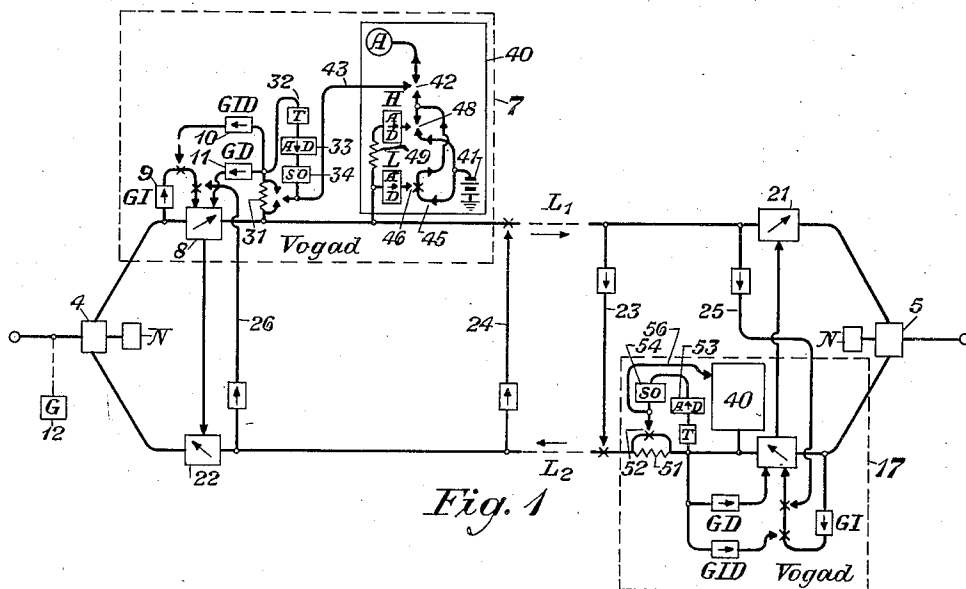
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SIGNALING SYSTEM

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SIGNALING SYSTEM

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9 Claims. (Cl. 178-44)

This invention relates to a signaling system, and more particularly to a telephone communication system containing a voice operated gain adjusting device, commonly called a "vogad," which possesses the characteristic of delivering to the transmission line speech waves of substantially constant volume independently of whether the speaker is a weak or a strong speaker. This application is a continuation as to common subject matter of our application Serial No. 45,644, filed October 18, 1935.

In such a transmission line it is common to transmit a ringing current of a definite frequency and constant amplitude, or to make tests from time to time on the transmission characteristics of the line, and to do this latter with alternating currents of definite frequency and constant amplitude, the frequencies chosen for testing lying preferably in the signaling range. The type of circuit here in mind is that known as a four-wire circuit, and the vogad used with it is placed in the transmitting side at the terminals. The vogad is of the type shown in patent to Hogg et al., No. 1,853,974, April 12, 1932, and consists essentially of a variable gain device or "vario-repeater," the gain being determined at any time by the volume of the signal coming to the input of the gain device. This variable gain device or repeater has associated with its input a gain increaser which functions to increase the gain of the repeater when the incoming speech is above a certain predetermined minimum power level, and does this ordinarily by changing the charge on a condenser placed in the grid circuit of the repeater. There is also associated with the repeater at the output side a gain increase disabler which serves the function when the output of the repeater exceeds a certain predetermined amount of opening a circuit in the gain increaser in such manner as to isolate the biasing condenser in the grid of the vario-repeater. Also connected to the output of the repeater is a gain decreaser which serves the function when the output exceeds another higher predetermined value of changing the charge on the biasing condenser in such a direction as to decrease the gain of the repeater.

The vogad as a whole has the characteristic of responding rather slowly to the typical peaks of a speech message, bearing in mind that the actual power of the speech message delivered by the repeater is well below what it would have been were the amplitude of the output constant and of a value corresponding to the peaks. If, now, there is impressed on the input of the vogad

an alternating current of constant amplitude, then the vogad will be set in accordance with that amplitude and the power delivered will be considerably higher than would be the case of a speech message having peaks substantially of the same value as the amplitude of the steady alternating current. This may lead to overloading of repeaters and other undesirable characteristics, and the purpose of this invention is to provide means whereby the gain of the vogad is definitely lower if a constant alternating current is impressed at the input than would be the case if it were set in the same way as it would be for speech; that is, the purpose is to overcome the tendency of the vogad to adjust itself for too high a gain for a steady alternating current.

Another purpose of the invention is to provide means which will operate an alarm or give some other suitable signal if the output of testing current from the vogad to the line does not lie within certain limits, thus indicating that some portion of the circuit, and in particular the vogad, is not functioning properly.

The invention will be better understood by reference to the following specification and the accompanying drawing, in which Figure 1 shows a transmission line with a vogad and the elements which comprise the means to carry out our invention; Fig. 2 shows the invention applied to volume control devices other than the vogad; and Fig. 3 shows a portion of such means in greater detail.

Referring more specifically to Fig. 1, there is shown a four-wire circuit consisting of the lines L_1 and L_2 with terminating sets 4 and 5 by which the transmission line is transformed from a two-wire to a four-wire basis, or the reverse. For simplicity a single line is shown for circuit L_1 and also for L_2 but it is to be understood that these are actually each a pair of wires. On the transmitting side of the circuit at the terminal 4, there is introduced a vogad 7 with supplementary apparatus to be described hereinafter. The vogad comprises the vario-repeater 8, the gain increaser 9, the gain increase disabler 10 and the gain decreaser 11, the details of the operation of which are all described in such a patent as that to Hogg et al., referred to above. Identical equipment 17 is shown on the transmitting side at the terminal 5. The circuit also shows on the receiving side, at each terminal, a reverse vogad 21 and 22; also terminal echo suppressors 23 and 24 and gain change suppressors 25 and 26, the arrangement and the performance of which are fully described in such a circuit as 55

shown in application of Wright and Abraham, Serial No. 752,150, filed November 8, 1934, now Patent No. 2,043,403, issued June 9, 1936, and the circuit as thus far described does not constitute a portion of this invention.

As stated above, it is sometimes desirable to send ringing current over such a circuit or to send testing current, in both cases the currents being alternating and of constant amplitude. Also, as pointed out, the gain of the vogad in this case is set at too high a value. Such a source of alternating current is shown at 12 near the terminal 4, and it is to be understood that it may be associated with the transmission line in any suitable manner, indicated conventionally only in the drawing.

In Fig. 1 two methods are shown for overcoming the difficulty. One of these is shown in connection with the vogad 7 and the other is shown in connection with the vogad 17. A description will be first given for that shown in the vogad 7. In the circuit derived from the output of the repeater 8 and which normally supplies power to the elements 10 and 11, we place a loss device 31 which may consist of a resistance network, represented here by a single resistance element. Beyond this element 31 and at the input of the elements 10 and 11 there is a derived circuit 32, which then goes through a circuit T tuned to the frequency of the ringing current or the testing current. Having passed through the tuned circuit T, the alternating current passes through an amplifier-detector 33 to control a slow-operate relay 34 which, in case it is operated, will short-circuit the element 31, thus effectively rendering the gain increase disable and the gain decrease more sensitive so that the repeater 8 is not adjusted to so high a gain for a given output as when the element 31 is in the circuit. The sensitivity of the relay 34 is adjusted so that it will operate and short-circuit the element 31 on ringing or testing current.

The device thus far described carries out one of the purposes of our invention, namely, to reduce the gain of the vogad for steady alternating current input. In addition, however, it may be desired that an alarm shall be given in the event that this portion, or some other portion, of the vogad assembly is not functioning in a manner to give an output which is between certain desired limits. To this end we supply the equipment shown at 40 which comprises an alarm A to be operated from a battery 41. This alarm cannot in any case be operated unless the circuit from the battery 41 is closed at the point 42 by means of a circuit 43 derived at the output of the slow-operate relay 34, and this derived circuit in turn does not function unless steady alternating current of a frequency which will pass the tuned circuit T is present. In case the circuit at 42 is closed, then the alarm may be operated through one of two paths. The first of these traces through the circuit 45, which circuit is normally closed at the point 46 if the power on the transmission line is less than a lower specified limit, and under these conditions the alarm will be sounded to call attention to the abnormal condition. If the power on the line exceeds the specified value, then the circuit at 46 is broken by the amplifier-detector L and no alarm is sounded. In case the power on the line exceeds a certain higher specified value, then the circuit at 48 is closed through operation of the amplifier-detector H and again

the alarm A gives an indication calling attention to an abnormal condition. The power value on the line at which the amplifier-detector H will function can be adjusted as desired by such a means as the loss element 49. As a result of these circuit arrangements it is evident that we have accomplished the second purpose of our invention, namely, to provide a signal device which will give a suitable alarm in the event that the power on the transmission line is at too low or too high a value.

The second method by which we accomplish the purposes of our invention is shown at 17 at the right-hand side of Fig. 1. In this arrangement the same type of vogad comprising a vario-repeater, a gain increaser, a gain decrease, and a gain increase disable is shown with the elements in the same relationship to each other as in the equipment at 7 but without the loss element 31 of 7. In series with the transmission line is a loss element 51, normally short-circuited at 52. In case, however, a ringing current or a testing current is impressed on the line, a portion of this current will pass through a derived circuit including the tuned circuit T, the amplifier-detector 53 and the slow operate relay 54, which may be identical to the corresponding tuned circuit and relay of 7. Such steady alternating current causes operation of the relay 54, opening the short circuit at 52 and thus introducing the loss 51 in series with the line, the loss being of such value as to bring the alternating current power to the desired value. The alarm device in this case is also analogous to that previously described and is indicated by 40, the circuits of 40 being controlled by the derived circuit 56 from the output of the relay 54.

The description up to this point has dealt with the application of a special tone-operated circuit to a vogad. It is, however, quite possible to apply this same means of tone adjustment to any volume control device. Such volume control devices might be in the form of compressors or expanders as described in a patent to Green, No. 1,738,000, dated December 3, 1929, or a device such as the half-vogad which is described in a patent to Doba, No. 1,854,828, dated April 19, 1932.

Referring to Fig. 2, a transmitting volume control device 1 is shown in the outgoing transmitting line. At the output of this device the tuned circuit 32, amplifier-detector 33, and slow-operate circuit 34 are shown. When the slow-operate circuit operates it inserts the loss 31 in the line. At the same time it operates the alarm device 40, which is identical with the alarm device shown in Fig. 1. Thus, if the volume control device 1 is operating correctly, the proper value of testing tone is sent out on the line, but if it is operating incorrectly, the alarm device 40 will indicate this immediately.

At the receiving end of the circuit another volume control device 1' is used. This device may be completely independent of the transmitting volume control device at that end of the circuit. At the output of this device the same mechanism is indicated, a tuned circuit 32', amplifier-detector 33', slow-operate circuit 34', and an alarm circuit 40'. However, in this case it is assumed that it is desirable to increase the amount of testing power over that which is normally put out by the volume control device 1'. Thus, operation of the slow-operate circuit removes the loss

31', thereby increasing the testing power supplied to the two-wire line.

It will be obvious from the above that the general principle of an auxiliary tone adjusting device for volume control circuits might be applied to a large variety of volume control devices.

The tuned circuit and slow-operate relay in any of the modifications shown may take on a variety of forms. One form which is suitable for carrying out our invention is shown, for illustrative purposes only, in Fig. 3 and comprises a high impedance input to an amplifier-detector. This high impedance input may be obtained in a well-known manner by means of condensers C₁, C₂ and C₃, along with the inductance of the transformer, all adjusted to respond only to the ringing current or testing frequency which it is desired to use. From the input coil the waves affect the amplifier-detector and, if strong enough, cause a current to flow in the plate circuit of this detector. Alternating current components are bypassed by the condenser C₄ and the direct current operates the master relay 60 which, in turn, initiates the release of the test zone relay 61. This latter, which is normally held operated, remains operated for a considerable length of time due to the charging up of the condenser C₅ through the high resistance 63 and the windings of the relay 61, thus making effectively a slow-operate circuit.

The release of the relay 61 is made to perform the desired function in the vogad circuit.

It is obvious that many changes may be made in the circuit arrangement. For example, instead of having the circuit T tuned to a single frequency it could be designed to permit passage of any desired number of chosen frequencies, and this in general might be desirable because a proper testing of the transmission line would call for measurements at several of the frequencies in the signaling range and these might all be different from the ringing frequency. Furthermore, it might be desirable in some cases to use two or more control units, one for testing current and one for ringing current. There might also be certain circuit arrangements where a vogad would be used at only one end of the circuit.

What is claimed is:

1. In a volume controlled circuit, a vogad adapted to deliver substantially constant value of speech message to the line, the gain of the vogad being set by the peak values of the incoming speech to it, a source of alternating current of constant peak voltage for occasional impression on the line, and means when said alternating current is present to reduce the gain of the vogad with reference to the normal gain for that input peak voltage.

2. In a volume controlled circuit, a vogad adapted to deliver substantially constant volume of speech message to the line, the gain of the vogad being set by the peak values of the incoming speech, a source of alternating current of constant peak voltage for occasional impression on the line, and means when said alternating current is present to introduce loss in the main transmission line to reduce the effective transmission level of the line over that normal for speech message of the same peak voltage as the alternating current source.

3. The combination of claim 1 characterized by the fact that the means for reducing the gain of the vogad with reference to the normal gain

consists of a loss in the input circuit of the control of the vogad, this loss being switched in during operation for speech and being shunted out when the said alternating current source is connected in.

4. The combination of claim 2 characterized by the fact that the means to introduce loss in the transmission line is a series network which is normally short-circuited but which is introduced when the alternating current source is connected.

5. In a volume controlled circuit, a vogad adapted to deliver substantially constant volume of speech message to the line, the gain of the vogad being set by the peak values of the incoming speech, a source of alternating current of constant peak voltage for occasional impression on the line and means when said alternating current is present to reduce the gain of the vogad with reference to the normal gain for that input peak voltage and to operate an alarm if the vogad output for said alternating current is of abnormal value.

6. In a volume controlled circuit, a vogad adapted to deliver substantially constant volume of speech message to the line, the gain of the vogad being set by the peak values of the incoming speech, a source of alternating current of constant peak voltage for occasional impression on the line and means when said alternating current is present to reduce the gain of the vogad with reference to the normal gain for that input peak voltage and to operate an alarm if the vogad output for said alternating current is below a specified value and above another specified value.

7. The combination of claim 1 characterized by the fact that the means for reducing the gain of the vogad with reference to the normal gain consists of a resistance network in the derived circuit at the output of the vogad leading to the vogad controls, the network being short-circuited when the said constant alternating current source is connected in.

8. In a volume controlled circuit, a vogad adapted to deliver substantially constant volume of speech message to the line, the gain of the vogad being set by the peak values of the incoming speech, a source of alternating current of constant peak voltage for occasional impression on the line and means when said alternating current is present to introduce loss in the transmission line to reduce the effective transmission level of the line over that normal for speech message of the same peak voltage as the alternating current source and to operate an alarm if the vogad output for said constant alternating current is below a specified value and above another specified value.

9. In a volume controlled circuit a device adapted to regulate speech volume at the input of the circuit, the gain of this device being set by some function of the variable peak speech voltages incoming to it, a source of alternating current of constant peak voltage for occasional impression on the line, and means operating when said variable peak gain setting voltages are not present and in response to said constant peak alternating current to set the gain of the volume control device with reference to the normal gain for that input peak voltage.

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