April 15, 1941. H. L. BARNEY ET AL 2,238,028

TELEGRAD

Filed July 8, 1939 4 Sheets-Sheet 1

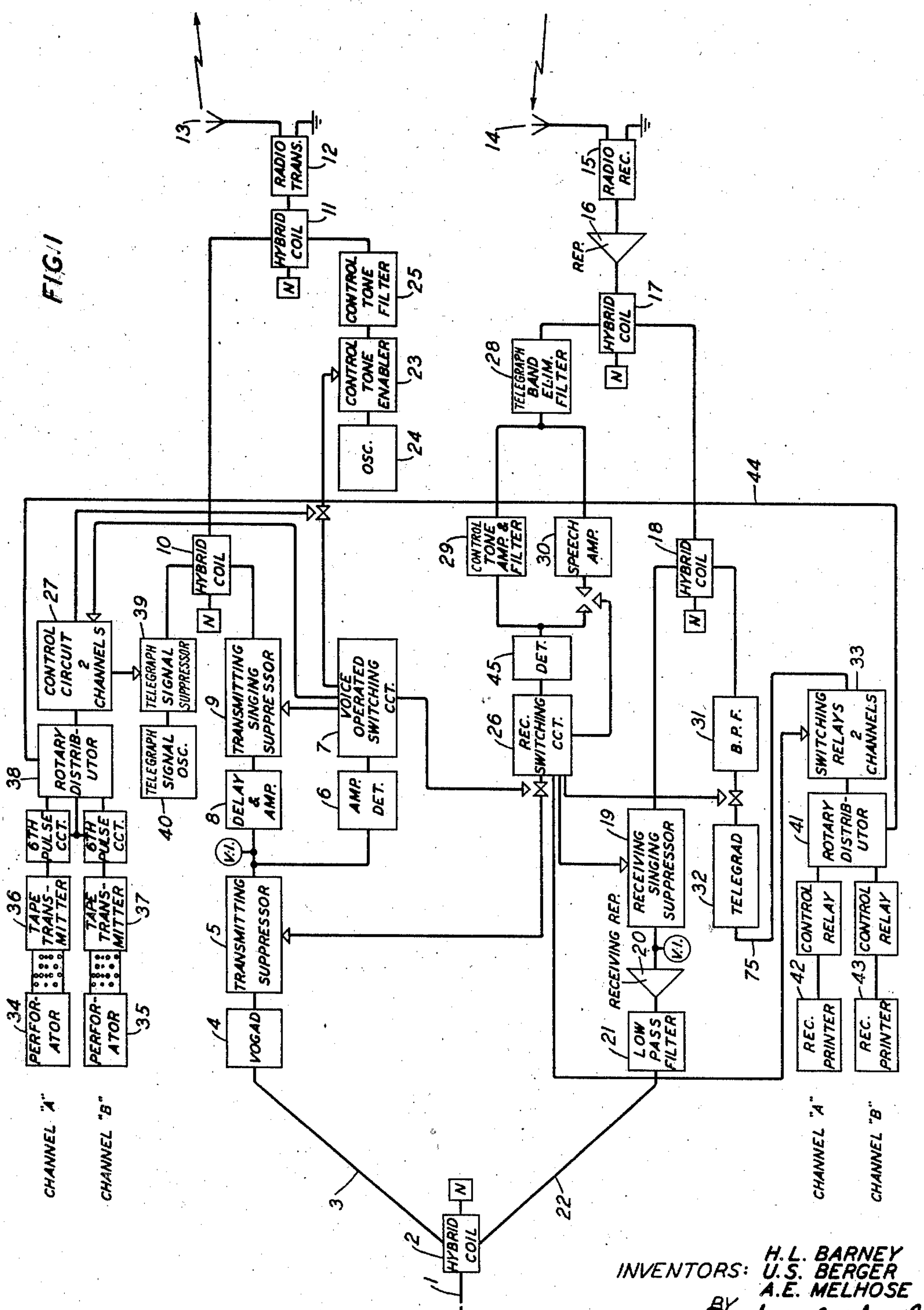

FIG. 1

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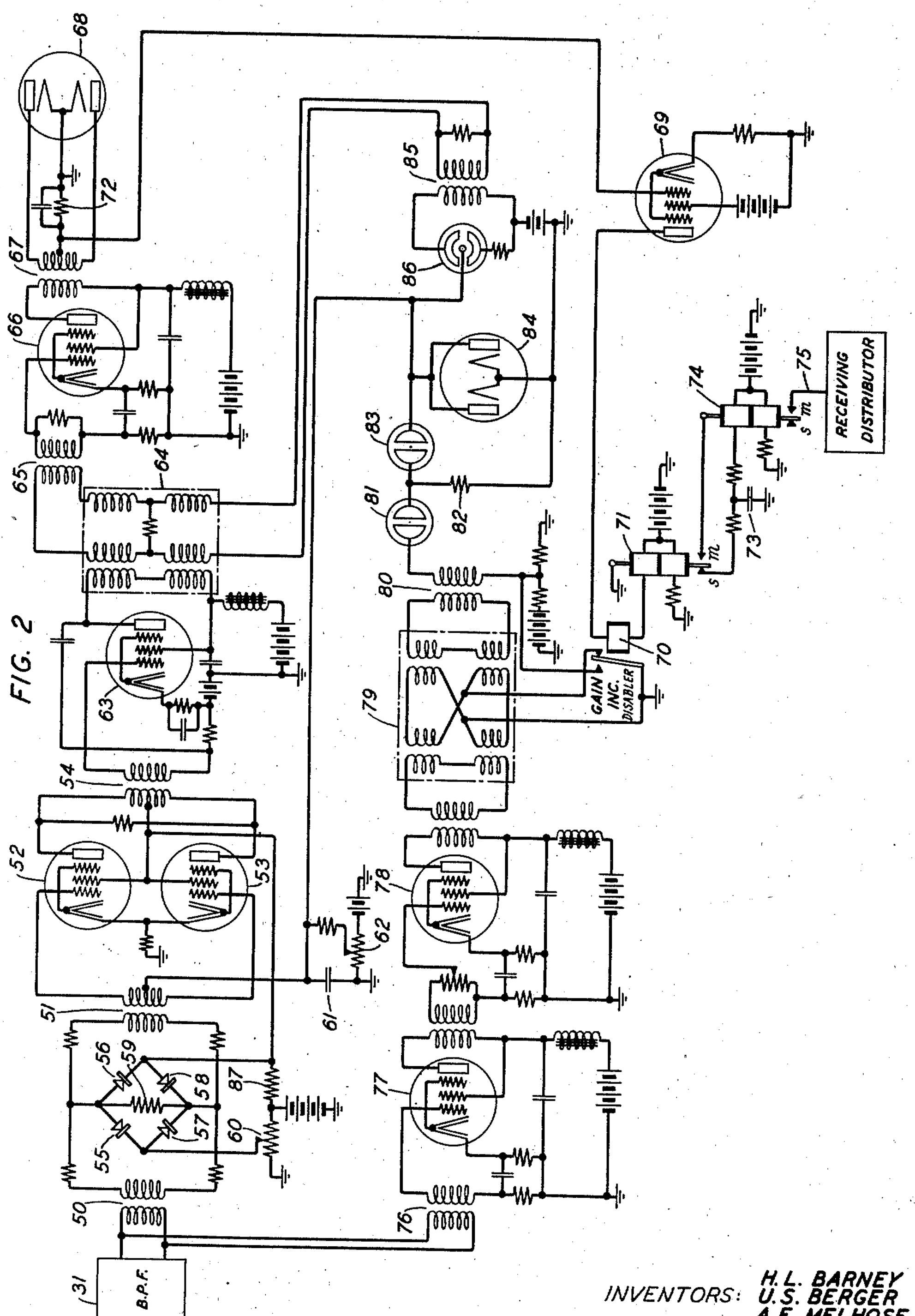
TELEGRAPH

Filed July 8, 1939 4 Sheets-Sheet 2

FIG. 2



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TELEGRAD

Filed July 8, 1939 4 Sheets-Sheet 3

FIG. 3

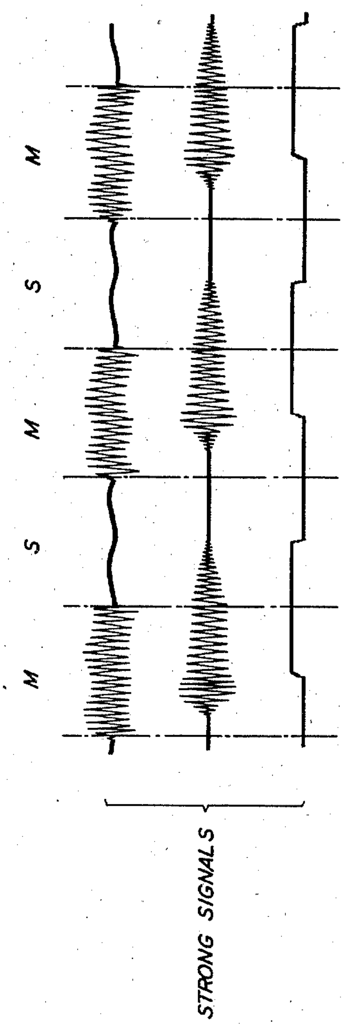

FIG. 4

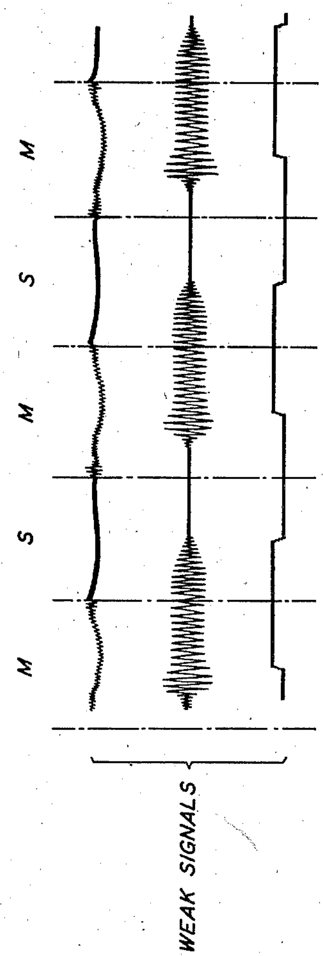

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FIG. 5

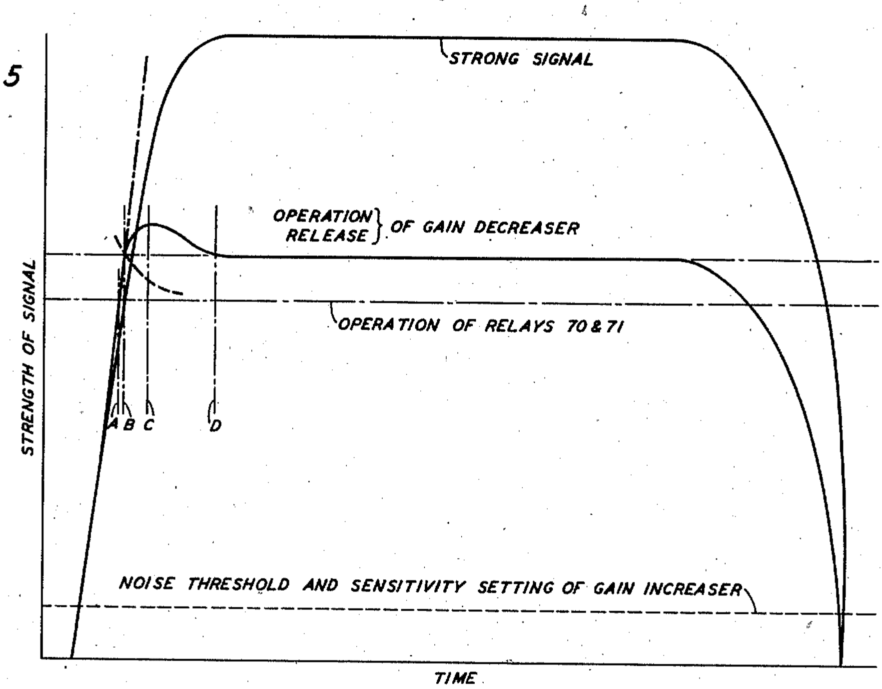
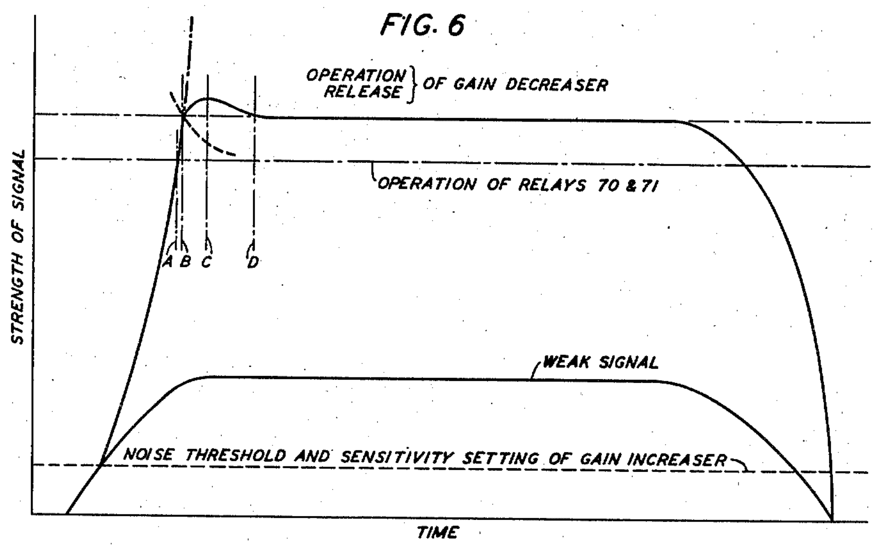


FIG. 6



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UNITED STATES PATENT OFFICE

2,238,028

TELEGRAD

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Application July 8, 1939, Serial No. 283,368

19 Claims. (Cl. 178—66)

This invention relates to communication systems and particularly to telegraph systems operating over channels subject to influences giving rise to great variations in the strength and quality of signals received.

The object of the invention is to regulate received signals in such manner as to deliver to receiving apparatus signals of uniform amplitude and length.

A feature of the invention is a telegraph gain regulating amplifier-detector which will hereinafter be termed a telegrad. The object of this device is to regulate telegraph signals received over a mutable link such as a badly fading radio circuit and to render such signals uniform in strength. A feature of this circuit is fast forward-acting gain increasing circuit, a fast backward-acting gain decreasing circuit and a gain increase disabler. The telegrad has features of similarity to the well-known vogad (voice operated gain adjusting device) shown, for instance, in Patent 1,853,974, granted April 12, 1932, to Hogg et al., Patent 1,936,658, granted November 28, 1933, to Bjornson et al., Patent 2,012,810, granted August 27, 1935, to S. Doba, and Patent 2,156,622, granted May 2, 1939, to S. Doba.

The telegrad, however, is designed to be extremely quick acting in comparison to the vogad and, for this reason, novel means have been incorporated in the new circuit in order that proper control of the device may be exercised. For example, both these devices employ a gain increaser disabler for the purpose of halting the effect of the gain increaser when it has increased the gain of a vario-repeater to a given point. Due to the high alternating current voltages at the output of the gain increaser circuit, it is not possible to use a mere relay contact to disable the increaser circuit output. Hence, a feature of this circuit is a two-step device for first cutting off the energizing path to the gain increasing means and secondly and thereafter to reduce the enabling bias of the gain increasing means.

Expressed in another manner, the gain increaser circuit employed herein is to a certain extent automatic and comprises two parts, an activating circuit and an enabling circuit. The activating circuit starts it into operation with the enabling bias applied and the disabling means acts to first disable the activating circuit and to secondly, disable the enabling circuit.

In both the telegrad and the vogad, the gain of the vario-repeater is controlled by the potential of a condenser. It is, therefore, necessary when this condenser has been charged to a certain positive potential for gain increasing purposes, to cut off the charging circuit entirely to prevent any additional increase in the charge so as to maintain the gain of the vario-repeater constant.

In the particular embodiment of this invention herein described, the energizing circuit for the gain increaser passes through what is known as a crossed coil device, that is, a transformer arrangement which in one condition inserts a high loss in the circuit and in another condition inserts a negligible loss in the circuit while maintaining an approximately even electrical constant condition therein. This well-known device, shown in Patent 1,749,851, granted March 11, 1930, to H. C. Silent, renders the circuit open for transmission of alternating currents in the low loss condition and practically opaque for such transmission in the high loss condition. The output of this crossed coil device is connected between a source of positive potential and a cold cathode gas tube in the charging circuit of the gain regulating condenser circuit so that energy traversing the crossed coil device will actuate the cold cathode gas tube and cause a flow of direct current for charging the condenser. The action is stopped by first changing the condition of the crossed coil device from a low to a high loss and, subsequently, reducing the positive potential in the condenser charging circuit. Thereby, the gain regulating condenser is left at a desired potential which may further be regulated by the gain decreaser circuit.

In accordance with another feature of the invention, economy of apparatus and insurance against difference in sensitivity between different circuits is achieved by operating the gain increase disabler from the signal circuit which is the final output of the telegrad, or, in other words, using the direct current signals themselves for operating the disabler. In the vogads, the gain increase disabler was part of the vogad and, therefore, required certain apparatus in the nature of an amplifier and detector for operating the relay means which performed the function of disabling the gain increaser circuit. The telegrad, however, may be considered as the combination of a vogad and an amplifier-detector for operating a signal circuit in which the gain increase disabler of the vogad is operated from the signal circuit beyond the amplifier-detector. By this means the expense of providing the usual amplifier-detector of the gain increase disabler is saved. Since the disabler is now worked by the final signal circuit, exact synchronism of the gain increase disabler and telegraph functions is insured.

Another feature of this invention is what may be termed a pulse chopping circuit, which acts to compensate the final direct current signals for length gained in intermediate transformation so that the final uniform strength direct current signals are equal in length to the original varying strength alternating current signals. A feature of this circuit is a pair of relays, the first of which is directly responsive to the direct current signals from the amplifier-detector and the second of which is responsive to the first. Between the first and second of these relays there is a delay circuit so that the second does not move its armature until a specified time after the energization of the first. Through a circuit controlled by the armatures of both these relays, the output signals are controlled at their beginning by the second relay and at their end by the first relay. A feature of the invention, then, is a signal timing circuit which effectively shortens the output signals by cutting off a portion of the beginning of each.

Another feature of the invention may be said to reside in the method of transforming varying strength alternating current signals into equal length direct current signals which consists essentially of three steps; first, the transformation of the different strength alternating current signals into uniform strength alternating current signals; second, the transformation of such uniform strength alternating current signals into direct current signals, and, third, the adjustment of the length of the direct current signals to the length of the original signals. The intermediate stage signals are spoken of as uniform strength signals to denote the fact that regardless of the strength of the original signals, such intermediate stage signals are always approximately the same. The term "uniform" does not apply to the form of the intermediate signal throughout its length for such signal is not strictly uniform in that sense. Actually, due to preliminary filter build-up and tail-off and due to the extreme rapidity of the gain increaser action, each signal has what may be termed an enlarged head, a major body portion of approximately uniform amplitude, and a gradually decreasing and elongated tail end. The gain increaser acts so rapidly that by the time the disabler can operate, and due also to the fact that the backward-acting gain decreaser is less sensitive, the gain has been brought to a slightly higher level than is necessary. This gives a characteristic enlarged head effect to the signals.

Where the signals are of the order of twenty milliseconds in length, the enlarged head is of the order of five milliseconds in length and where the tail end of the signal is elongated in the order of five milliseconds, the signal is compensated by cutting off about five milliseconds of its head.

It will then be realized that the regulated signals will be displaced somewhat in time, but, since this displacement is uniform for all signals, the usual orientation means may be used for purposes of synchronization. Another feature of the invention, then, is the combination of a telegrad comprising a fast-acting vogad, an amplifier-detector beyond the vogad controlling the gain increase disabler of the vogad and a pulse chopping circuit and an orientation means for insuring the correct operation of telegraph receiving mechanism by signals badly distorted in respect of their strength.

The drawings comprise four sheets. The first contains Fig. 1 illustrating by a general schematic diagram the manner in which the present invention fits into a comprehensive communication system.

Fig. 2 is a circuit diagram showing the telegrad in detail. This diagram is schematic to the extent that in each vacuum tube the heater element or filament is merely indicated and the actual connections thereto are not shown since the method of making such connections is well known.

Figs. 3 and 4 are explanatory diagrams illustrating the transition of a signal from the signal delivered to the telegrad, the intermediate stage signal and the direct current signal delivered to the signal receiving apparatus by the telegrad. Fig. 3 shows a strong signal and Fig. 4 shows a weak signal.

Figs. 5 and 6 are theoretically devised graphs showing the time of operation of the various parts of the circuit whereby the intermediate stage signals are properly formed.

Fig. 1 is a general schematic of the system in which the telegrad, subject of the present invention, is employed. A speech path 1 leads to a hybrid coil 2 from which a path 3 for outgoing speech leads to a vogad 4. The outgoing speech then passes through a transmitting suppressor 5 and by means of an amplifier-detector 6 operates a chain of relays 7 here labeled as "voice operated switching circuit." This voice operated switching circuit controls a transmitting singing suppressor 9 so that the outgoing speech can pass from the transmitting suppressor 5 through the delay and amplifier 8 and the transmitting singing suppressor 9 to the hybrid coil 10. From the hybrid coil 10 the speech reaches another hybrid coil 11 and thence goes through the radio transmitter 12 to an antenna 13. Through radio transmission the speech will be received at some distant point and for purposes of explanation it will be assumed that the distant point has a receiving circuit similar in all respects to the lower part of Fig. 1. The speech therefore enters antenna 14, passes through a radio receiver 15 and a repeater 16 to a hybrid coil 17. From the hybrid coil 17 the speech goes into hybrid coil 18, thence through the receiving singing suppressor 19, the receiving repeater 20, a low-pass filter 21 and a path 22 to a hybrid coil such as 2, whence it goes to the receiving subscriber over a line such as 1.

The voice operated switching circuit 7 controls a control tone enabler 23 so that a source of control tone 24 is passed through the control tone filter 25 to the hybrid coil 11 and thus accompanies speech. The voice operated switching circuit 7 also controls a switching point leading from the receiving switching circuit 26 at the same terminal to the transmitting suppressor 5 so as to open this circuit during the periods that speech is going out from line 1 to antenna 13. During this time the voice operated switching circuit 7 also controls the telegraph control circuit 27 to stop the action of the telegraph transmitting circuit.

At the receiving end the control tone with the usual modulation of the carrier frequency coming in over antenna 14 is demodulated in radio receiver 15 and passes through hybrid coil 17 and thence through a telegraph band elimination filter 28 and into a control tone amplifier and filter 29. This operates the receiving switching circuit 26 which performs several functions as follows. First, the receiving switching circuit 26 controls a normally open circuit between the telegraph band elimination filter 28 and the receiving switching circuit 26 including a speech amplifier 30. This is provided so that when control tone is first received the receiving switching circuit 26 will be operated thereby and then held operated thereafter by speech currents flowing through the amplifier 30.

The receiving switching circuit also controls the receiving singing suppressor 19 to open up the speech path. The receiving switching circuit 26 also controls a normally closed path between the band-pass filter 31 and the telegrad 32 so that while speech is being received the telegrad 32 will be disabled. At the same time, the receiving switching circuit 26 controls the switching relays for two telegraph channels 33.

During pauses in the speech, either when the subscriber at the distant end is talking into channel 1 or during the time when the subscriber on channel 1 pauses during his talk out over the antenna 13, the telegraph apparatus shown in the upper part of the figure is in operation. This comprises perforator 34 and 35 working, respectively, into tape transmitters 36 and 37 and thence into rotary distributor 38. Rotary distributor 38 works through the control circuit 27 which exercises control over the telegraph signal suppressor 39. A source of telegraph signal tone is supplied by the telegraph signal oscillator 40 and through the action of the telegraph signal suppressor 39 under control of the control circuit 27 sends telegraph signals into the hybrid coil 10, thence through the hybrid coil 11 and out over the radio transmitter 13.

At the distant end these telegraph signals, in the form of spurts of alternating current of the usual form of a carrier of the oscillator frequency with side bands about 75 cycles wide caused by the modulation of the carrier by the telegraph transmitter are received over antenna 14 by the radio receiver 15 and thence through the repeater to pass through the hybrid coils 17 and 18 to the band-pass filter 31. Thereafter, the signals enter the telegrad 32 and are converted from varying strength alternating current signals to uniform strength direct current signals of practically the same length at which they were received over the antenna 14. These direct current signals then pass through the switching relay circuit 33 and the rotary distributor 41 to the two printers 42 and 43. During the reception of telegraph signals the receiving switching circuit 26 is unoperated and the speech path is blocked off by the receiving singing suppressor 19.

A line 44 schematically represents a means for keeping the rotary distributor 38 in exact synchronism with the distant rotary distributor 41. The rotary distributor 38 and the rotary distributor 41 at the same terminal may or may not be kept in synchronism. In actual practice they generally are kept in synchronism for reasons having to do with the cost of synchronizing apparatus, but from an operating standpoint it is only necessary that the rotary distributors forming part of the same channel be kept in synchronism.

The telegrad 32 is shown in detail in Fig. 2. Signals coming from the band-pass filter 31 pass through a vario-repeater consisting of two stages, first, a copper-oxide vario-losser pad and, secondly, a push-pull variable-mu amplifier stage. The signals pass through a transformer 50 and thence through the copper-oxide vario-losser pad to transformer 51. From transformer 51 they pass in push-pull relation through two variable-mu suppressor-grid pentode tubes 52 and 53 to a transformer 54. The copper-oxide vario-losser pad comprises four copper-oxide rectifiers 55, 56, 57 and 58 connected in a bridge circuit across the outer terminals of transformers 50 and 51 with a pure resistance 59 bridged thereacross. The outer apex points of this bridge are connected in one case to a potentiometer 60 between plus battery and ground, and in the other case ot the mid-point of the primary of transformer 54. The current flowing in the copper-oxide bridge is then a function of the plate currents flowing in tubes 52 and 53 since the plate current drop across resistance 87 is balanced against the potential derived from potentiometer 60. The larger the plate current flowing through resistance 87, the smaller will be the direct current flowing through the copper-oxide bridge.

The important element in this vario-repeater is a condenser 61. The potential of the upper plate of this condenser determines the gain to the signal. The gain of the vario-repeater is increased by raising the positive charge on condenser 61 and is reduced by a corresponding reverse action adjustment. Through the use of a potentiometer 62 the potential of the upper plate of condenser 61 may be kept at such a point during idle periods that the vario-repeater is set at mid-gain.

The signals going out from transformer 54 pass through a suppressor-grid pentode tube 63 and thence to a hybrid coil 64. The output of this hybrid coil works into a transformer 65 and thence through a suppressor-grid pentode tube 66, acting as an amplifier, to a transformer 67 and thence to a full wave rectifier tube 68. Under normal conditions, that is, in the condition of a spacing signal, a suppressor-grid pentode tube 69 is so adjusted by the potential on the mid-point of the secondary of transformer 67 that current flows from the plate of tube 69 through the neutral relay 70 and the upper winding of relay 71, holding them in the positions shown.

When a marking signal is transmitted then a direct current voltage is produced across the diode resistance 72 and the negative voltage reduces the plate current from tube 69 to the point where relay 70 releases and the biasing current in the lower winding of relay 71 drives this relay to its marking contact. When relay 71 moves from its spacing contact, a short circuit on hang-over condenser 73 is removed and this condenser in time is charged by the positive battery connected through the upper winding of relay 74. This charging current holds relay 74 on its spacing contact for the hang-over period. Thereafter, as the biasing current through the lower winding of relay 74 becomes effective and relay 74 moves to its marking contact, a circuit is closed from ground through the armature of relay 71 and its marking contact, thence through the armature of relay 74 and its marking contact to the receiving distributor lead 75.

Since the telegrad is used at the output of a selective filter 31, the length of the pulses reaching the input is longer than the signal transmitted. Since relay 71 follows the signals at the input of the telegrad, the circuit including relays 71 and 74 and the hang-over condenser 73 is provided to regulate the length of the pulses going out on lead 75 to the length of the pulses before they pass through the band-pass filter 31.

In general terms, then, alternating current impulses which may vary from strong signals to very weak signals over a range of some 45 decibels are converted by the vario-repeater into alternating current signals of a practically uniform amplitude. These signals then pass through an amplifier-detector and appear at the output of the tube 69 as direct current signals and later in the lead 75 as direct current signals of uniform strength and of a length equal to the signals delivered to the band-pass filter 31.

It was pointed out above that the potential of the condenser 61 is normally adjusted by the potentiometer 62 to the point where the vario-repeater is set at mid-gain. If a very weak signal is received, a gain increaser circuit operates to bring up the gain of the vario-repeater in a very short time. This time, for example, may be a minor fraction of a signal length. For a further specific example, this period may be of the order of 5 to 6 milliseconds, so that where the signal length is of the order of 22 milliseconds the time taken to change the gain of the vario-repeater becomes a minor fraction of the signal length.

The signaling current then passes into a transformer 76 through two amplifiers comprising essentially two suppressor-grid pentode tubes 77 and 78 to a variable loss device 79. When relay 70 is in the position shown, the variable loss device 79 is in such condition that the alternating current signal will manifest itself in transformer 80 and thus place an alternating current potential on the terminal of the cold cathode gas-filled tube 81. This breaks down the gas tube and current flow therethrough is started, current flowing from a plus battery through the tube 81, resistance 82 to ground. The drop across resistance 82 causes a second cold cathode gas tube 83 to break down and thus apply positive potential to the condenser 61. Since the impedance in this condenser charging circuit is very low, the condenser 61 is charged rapidly and the gain is changed, for example, in the order of 20 decibels in approximately 5 milliseconds.

When the gain has been brought up to the point where a direct current signal is produced by the tube 69, manifesting itself through the release of relay 70 and the movement of relay 71 from its spacing to its marking contact, this gain increaser circuit is disabled.

The disabling is done in two steps; first, the armature of relay 70 moves from its front contact and thus opens the circuit of the variable loss device 79 so that this circuit now becomes opaque to alternating current and the alternating current ceases to flow in the transformer 80. Thus the circuit for activating the tube 81 is disabled. Secondly, and shortly thereafter, when the armature of relay 70 reaches its back contact, a ground is placed on the lower side of the secondary winding of transformer 80 so that the enabling voltage normally applied to cold cathode tube 81 is reduced.

Heretofore the gain increase disabler of circuits, known as vogads, have been operated directly by relay contacts. An analogy would be the charging circuit for condenser 61 passing through the contacts of relay 70. The transient voltage of this circuit, however, on opening the charging circuit, is so high that the relay contacts cannot be used alone, and hence the gain increaser is disabled in the two-step manner just described, consisting of first disabling the activating circuit, and second in disabling the operating circuit of the gain increaser.

In order to keep the potential on the control condenser 61 from going too high when the gain increaser operates, the condenser 61 is shunted by a diode rectifier 84. This limits the voltage of the condenser 61 to a predetermined maximum value.

Two leads coming from the lower part of the hybrid coil 64 lead to a transformer 85 to apply voltage to the control gap of a cold cathode gas-filled tube 86. This breaks down the main gap and causes the control condenser 61 to be charged negatively. This circuit constitutes a fast-operate backward-acting gain decreaser. This circuit, for example, will reduce the gain by 20 decibels in a period of 4 milliseconds.

Generally the action of the telegrad is as follows. When a weak signal is received, the gain increaser circuit causes the cold cathode tubes 81 and 83 to close the circuit for the charging of condenser 61 from a source of positive potential, which acts to rectify the alternating current of the signal transmitted through tubes 77 and 78.

As the level of the signal at the hybrid coil reaches a predetermined point, the relay 70 will be released and the gain decreaser circuit will come into operation. Due to certain electrical delays and the mechanical delay in the armature travel time of relay 70 the gain increaser is not disabled until the gain has gone slightly above the desired point. The gain decreaser then adjusts the signal with the result that a characteristically enlarged head is given to the intermediate stage signal, that is, the signal as it passes through the hybrid coil 64.

When a strong signal is received the gain decreaser and the gain increase disabler relay operate at once subject to the inherent electrical and mechanical delays in the circuit and the gain increaser is disabled almost immediately again with the result that the intermediate stage signal appears to have a characteristically enlarged head.

By increasing the speed of the charging circuits of condenser 61 the enlarged head will be made more prominent and by decreasing such speed the enlarged head may be reduced to a minimum.

When the gain decreaser has brought the potential of condenser 61 down to the proper level, tube 86 will cease to function and the charge on condenser 61 will remain constant thereafter except for the slow drift to mid-gain through potentiometer 62.

This is shown graphically in the two theoretical diagrams of Fig. 5 and Fig. 6. Fig. 5 represents a strong signal and Fig. 6 represents a weak signal. Both of these figures show a graph of an intermediate stage signal as plotted between strength of signal and time. In both cases there is a dotted line a slight distance up on the scale of strength. This represents the noise threshold and the sensitivity of the gain increaser. As the signal reaches the telegrad, the gain increaser begins to operate and the gain increase follows the line which ends in a dot and dash line extending in an almost vertical direction in each figure. Some distance up on the strength of signal scale the gain increase crosses a dot and dash line marked "Operation of Relays 70 and 71." This is the operation of the gain increase disabler. The operate time of the gain increase disabler, however, allows the gain increase to continue until it reaches another dot and dash line further up on the scale of strength of signal. Above this line will be the operation of the gain decreaser and below this line will be the release of the gain decreaser. The gain decreaser, therefore, begins to operate at a point somewhat above the operation of the gain increase disabler and theoretically it would operate in a curve similar in shape to a dotted line passing through this point, but it must be understood that this dotted line is only an indication of the type of curve followed and is not an indication of the strength of current in this circuit. The net result is the deviation of the actual signal from the gain increase graph. This signal deviated in this manner reaches a high point and then begins to come down to the line representing the operate and release point of the gain decreaser. At the point A, the gain increase disabler begins to operate. At point B, the gain decreaser begins to affect the signal. Between points B and C both the gain increaser and the gain decreaser are operated. At point C the gain increaser has entirely ceased to function due to the completion of the operation of the gain increase disabler and from point C and to point D the gain decreaser operates to bring the signal down to the desired level. It will be noted that the intermediate stage signal is of practically the same shape and of the same strength in all cases. It is conceivable that if rapid fading of signals either up or down in strength is taking place that further adjustments might be made but the characteristic form of the signals shown in Fig. 5 and Fig. 6 will be maintained in all but extreme and rare cases.

This is further shown in Figs. 3 and 4, Fig. 3 representing a strong signal and Fig. 4 representing a weak signal. These figures have been drawn from oscillograms derived from actual experience and represent the transmission of the letter Y in a well-known code. In each case you have a marking signal in the first, third and fifth places and a spacing signal in the second and fourth places. The upper line in each case represents the signal as it enters the band-pass filter 31. The middle line represents the intermediate stage signal as it enters the amplifier-detector through the transformer 65 and the lower line represents the signal delivered to the receiving distributor over line 75.

It will be noted that the very strong signal of Fig. 3 produces practically the same intermediate stage signal as does the very weak signal of Fig. 4. Thus, the varying strength alternating current signals, represented by the upper lines of Figs. 3 and 4, are changed first into uniform strength alternating current signals, represented by the middle lines of Figs. 3 and 4, and finally into uniform strength direct current signals, as represented by the bottom lines of Figs. 3 and 4.

What is claimed is:

1. In a communication system, a telegrad comprising a variable gain device having a gain increase disabler, an amplifier-detector for operating a signal circuit and means in said signal circuit for operating the gain increase disabler of said variable gain device.

2. In a communication system, a signal gain adjusting device, comprising a vario-repreater, a forward-acting gain increaser for said vario-repeater, a gain increase disabler, and a backward-acting gain decreaser for said vario-repeater, an amplifier-detector, a signal circuit responsive to signals through said vario-repeater and said amplifier-detector and means in said signal circuit for operating said gain increase disabler.

3. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals comprising a vario-repeater for changing varying strength alternating current signals into substantially uniform strength alternating current signals, an amplifier-detector for changing said substantially uniform strength alternating current signals into direct current signals and means for regulating the length of said direct current signals.

4. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals comprising a band-pass filter, a vario-repeater for changing varying strength alternating current signals into substantially uniform strength alternating current signals, an amplifier-detector for changing said substantially uniform strength alternating current signals into direct current signals and means for compensating said direct current signals for change in length occurring in said conversions.

5. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals comprising a band-pass filter, a vario-repeater for changing varying strength alternating current signals into substantially uniform strength alternating current signals, said vario-repeater being controlled by a fast-acting gain increaser responsive to said varying strength alternating current signals, a gain increase disabler and a gain decreaser, an amplifier-detector for changing said substantially uniform strength alternating current signals into direct current signals, means for compensating said direct current signals for change in length occurring in said band-pass filter and means in said compensating means for controlling said gain increase disabler.

6. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals comprising a vario-repeater controlled by a gain increaser responsive to said varying strength alternating current signals and constructed and arranged to adjust the gain of said vario-repeater to a desired signal strength within a minor fraction of a signal length for changing said varying strength alternating current signals into substantially uniform strength alternating current signals, an amplifier-detector for changing said substantially uniform strength alternating current signals into direct current signals, means for adjusting the length of said direct current signals to the length of said varying strength alternating current signals and a gain increase disabler responsive to said direct current signals.

7. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals comprising a vario-repeater for changing said varying strength alternating current signals into substantially uniform strength alternating current signals and having gain controlling means for adjusting the delivered substantially uniform strength alternating current signal to a predetermined value within a minor fraction of the length of said signal, said gain controlling means comprising a fast-acting gain increaser responsive to said varying strength alternating current signals, a gain increase disabler and a gain decreaser, an amplifier-detector for changing said substantially uniform strength alternating current signals into direct current signals, and means to operate said gain increase

disabler by said direct current signals at the end of said minor fraction of the length of said signal.

8. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals, comprising a band-pass filter, a vario-repeater for changing said varying strength alternating current signals into substantially uniform strength alternating current signals, said vario-repeater being controlled by a gain increaser responsive to said varying strength alternating current signals, a gain increase disabler and a gain decreaser all constructed and arranged to function within a minor fraction of a signal length to adjust the delivered substantially uniform strength alternating current signal to a predetermined value, an amplifier-detector for changing said delivered signals to direct current signals, a first relay responsive to said direct current signals, a second relay responsive to said first relay, a delay circuit for said second relay and a circuit arrangement controlled by said relays for delivering uniform strength direct current signals, equal in length to the length of said varying strength alternating current signals.

9. In a communication system, means for converting varying strength alternating current signals into equal length uniform strength direct current signals comprising a vario-repeater for changing said varying strength alternating current signals into substantially uniform strength alternating current signals, said vario-repeater being controlled by a gain increaser responsive to said varying strength alternating current signals, a gain increase disabler and a gain decreaser, said gain controlling means being constructed and arranged to adjust the delivered substantially uniform strength alternating current signals to a predetermined value within a minor fraction of a signal length, an amplifier-detector for changing said delivered signals to direct current signals, a first relay responsive to said direct current signals, a second relay responsive to said first relay, a delay circuit for said second relay constructed and arranged to cause said second relay to operate a minor fraction of a signal length after the operation of said first relay and an output signal path controlled by said relays in such manner that said second relay controls the beginning of each signal in said output path and said first relay controls the end of each signal in said output path.

10. In a communication system, means for changing different strength alternating current signals into direct current signals comprising a band-pass filter and vario-repeater for changing said different strength alternating current signals into intermediate stage signals, said intermediate stage signals being elongated by said band-pass filter, means for changing said elongated intermediate stage signals into direct current signals, and repeating means for changing said direct current signals into uniform strength signals and for adjusting their length to be equal to the length of said different strength alternating current signals.

11. In a communication system the method of changing varying strength alternating current signals into equal length uniform strength direct current signals which consist in changing said varying strength alternating current signals into elongated substantially uniform strength alternating current signals, changing said elongated substantially uniform strength alternating current signals into direct current signals and shortening said direct current signals to a length equal to said varying strength alternating current signals.

12. In a communication system the method of changing varying strength alternating current signals into equal length uniform strength direct current signals which consists in changing said varying strength alternating current signals into alternating current signals having an enlarged head, a substantially uniform strength for a major portion of their length and a gradually decreasing and elongated tail, changing said last signals into direct current signals and cutting off a portion of said direct current signals corresponding to the enlarged head of said intermediate stage signals.

13. In a communication system the method of changing varying strength alternating current signals into equal length uniform strength direct current signals which consists in changing said varying strength alternating current signals into intermediate stage alternating current signals each having a major body portion of uniform strength, a minor head end portion of steeply rising strength slightly overshooting the strength of said major body portion and a minor tail end portion of elongated and gradually decreasing strength, changing said last signals into direct current signals and cutting off a portion of the head end of each of said direct current signals corresponding to the elongation of said intermediate stage signals.

14. In a communication system means for changing varying strength alternating current signals into equal length uniform strength direct current signals comprising a vario-repeater for changing said varying strength alternating current signals into intermediate stage alternating current signals, a fast-acting gain increaser for said vario-repeater, said gain increaser being responsive to said varying strength alternating current signals, a gain decreaser for said vario-repeater, a gain increase disabler responsive to second stage direct current signals whereby said vario-repeater is controlled by said gain controllers to shape said intermediate stage signals to have a major body portion of uniform strength, a minor head end portion of steeply rising strength slightly overshooting the strength of said major body portion and a minor tail end portion of elongated and gradually decreasing strength, an amplifier-detector for changing said intermediate stage signals into second stage direct current signals, a pulse chopping circuit for changing said second stage direct current signals into third stage direct current signals and for delaying the start of said third stage signals by an amount equal to the elongation of said first stage signals, whereby said third stage signals are delayed in time after said varying strength alternating current signals.

15. In a communication system, means for changing varying strength alternating current signals into equal length uniform strength direct current signals, comprising a vario-repeater, a gain increaser for said vario-repeater comprising a condenser for controlling the bias of said vario-repeater, a low impedance charging circuit for said condenser and an alternating current path for controlling said charging circuit by said varying strength alternating current signals, a gain increase disabler comprising a crossed coil transmission loss element in said alternating current path and additional means for stopping the charging of said condenser, and a gain decreaser

for said vario-repeater, an amplifier-detector for changing said alternating current signals after passing through said vario-repeater into direct current signals, relay means operated by said direct current signals for operating said gain increase disabler, and relay means operated by said direct current signals for delivering direct current signals equal in length to said varying strength alternating current signals.

16. In a communication system, means for changing varying strength alternating current signals into equal length uniform strength direct current signals comprising a vario-repeater, a gain increaser for said vario-repeater comprising a condenser for controlling the bias of said vario-repeater, a low impedance charging circuit for said condenser and an alternating current path for controlling said charging circuit by said varying strength alternating current signals, a gain increase disabler comprising a crossed coil transmission loss element in said alternating current path and additional means for stopping the charging of said condenser, and a gain decreaser for said vario-repeater, an amplifier-detector for changing said alternating current signals after passing through said vario-repeater into direct current signals, relay means for sequentially operating first said crossed coil transmission loss element and second said additional condenser charging stopping means, and means operated by said direct current signals for adjusting the length of said direct current signals.

17. In a comunication system, a vario-repeater, a gain increaser for said vario-repeater responsive to signals at the input of said vario-repeater comprising a low impedance condenser charging circuit including a cold cathode gas tube, and an alternating current path activating circuit for said cold cathode gas tube, a gain increase disabler comprising a variable loss transmission device in said alternating current path and quenching means for said cold cathode gas tube, and means for sequentially operating said variable loss transmission device and said quenching means.

18. In a communication system, a vario-repeater, a gain increaser for said vario-repeater responsive to signals at the input of said vario-repeater comprising a low impedance condenser charging circuit including a cold cathode gas tube and an alternating current path activating circuit for said cold cathode gas tube, a gain increase disabler comprising a variable loss transmission device in said alternating current path and quenching means for said cold cathode gas tube, a direct current relay responsive to the output of said vario-repeater and contact means operated by said relay for first operating said variable loss transmission device and second operating said quenching means.

19. In a communication system, means for changing varying strength alternating current signals of the order of twenty milliseconds in length into equal length uniform strength direct current signals comprising a vario-repeater, having a gain increaser responsive to said varying strength alternating current signals, a gain decreaser and a gain increase disabler constructed and arranged to change said varying strength alternating current signals into uniform strength alternating current signals within a period of the order of five milliseconds, an amplifier-detector for changing said uniform strength alternating current signals into direct current signals, relay means responsive to said direct current signals for operating said gain increase disabler and relay means also responsive to said direct current signals for repeating said direct current signals and for rendering said repeated signals shorter in length by a period of the order of five milliseconds.

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