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SIGNALING SYSTEM

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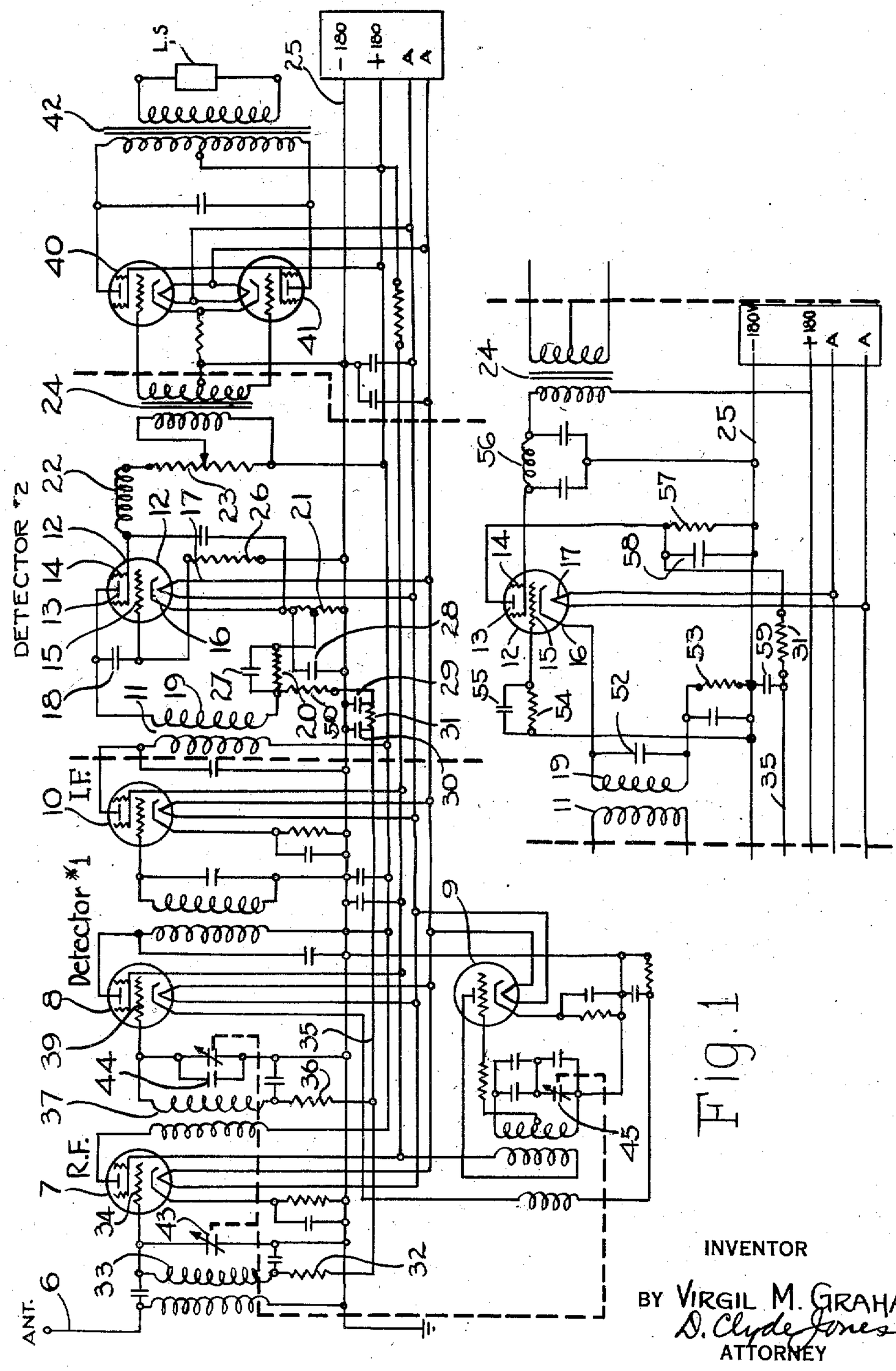

Fig. 2

Fig. 1

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SIGNALING SYSTEM

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This invention relates to signaling systems and more particularly to radio receiving systems.

It has been proposed to provide an automatic sensitivity control device or compensating means in a radio receiver whereby incoming signals of varying signal strength are reproduced as substantially uniform audio signals. It is well known that in such an automatic sensitivity control device, rectifying means is provided whereby the carrier wave component of an incoming signal is rectified to apply a regulating potential to the control grid of at least one of the vacuum tubes in a high frequency amplifying portion of the radio receiver. Such a rectifier has usually taken the form of a three-electrode vacuum tube which is physically independent from the detector tube or frequency translating device of the radio receiver.

In order to obtain a similar result, it has also been proposed to use certain of the electrodes of a multi-electrode vacuum tube for translating an incoming signal either at radio frequency or at an intermediate frequency into a signal at audio frequencies and to utilize other electrodes of this tube to rectify the carrier component of the incoming signal for the purpose of providing a controlling potential for regulating the automatic sensitivity in the amplifier portion of the radio receiver. In such an arrangement however, the translation of the incoming signal at radio frequencies or intermediate frequencies into audio frequencies by the rectifier or translating device, has been effected without any amplification or more strictly speaking, without any translation gain.

In accordance with the present invention, it is proposed to use a multi-electrode vacuum tube with certain of its electrodes functioning as a rectifier of the carrier component of the incoming signal in order to develope a regulating potential for certain of the high frequency amplifying stages of a radio receiver, whereby the sensitivity of a radio receiver is automatically adjusted to compensate for varying incoming signal strength and to employ certain other electrodes of this device to translate the incoming signal from either radio frequencies or intermediate frequencies into audio frequencies and this translation is effected with a material increase in signal gain popularly referred to as "amplification".

For a clearer understanding of the invention, reference is made to the drawing in which Fig. 1 is a diagrammatic showing of a radio receiver including the present invention, and Fig. 2 represents a modified form of second detector which may be substituted for that shown in Fig. 1.

Referring to Fig. 1, 6 designates an antenna or other signal collector which is linked to the input circuit of a radio frequency amplifying stage including the screen grid vacuum tube 7. The output of this radio frequency amplifying stage is coupled to a first detector including the vacuum tube 8. As is well known, this detector and oscillator 9 functions to translate the incoming signal at radio frequency into a predetermined intermediate frequency. The output circuit of the detector 8 is coupled to the input of an intermediate frequency amplifying stage including the screen grid vacuum tube 10, the output of which amplifying stage is coupled by means of a transformer 11 to the input circuit of a second detector including the five element screen grid tube 12. This tube includes a plate or anode 13, a screen 14, a control grid 15, a cathode 16, and a heater 17.

This second detector may be considered as comprising a portion operating to translate the amplified radio signal into audio frequencies and a second portion serving to rectify the carrier component of the amplified signal, all of which will be further pointed out. The first portion of the detector comprises the input network including the control grid 15, condenser 18, secondary winding 19 of the transformer 11, resistor 20, the upper portion of resistor 21, and the cathode 16, and also the output network of the detector connecting the screen 14, inductance 22, the upper portion of the potentiometer 23, primary winding of the audio transformer 24, to the positive terminal of the 180 volt source, through this source to grounded conductor 25, and thence to the cathode 16. It will be noted that a resistor 26 connects the control grid 15 to the grounded conductor 25, so that the control grid is maintained at a predetermined negative potential with respect to the cathode. It is well known that this type of the detector, in addition to translating the incoming signal from radio frequency into audio frequency, effects this translation with a substantial translation gain more commonly referred to as amplification.

The second portion of the detector includes the network connecting the anode 13, the secondary winding 19 of the transformer 11, resistor 20, and the upper portion of resistor 21 to the cathode 16. It will be readily recognized that this portion of the detector constitutes a true rectifier which functions to translate the carrier component of the radio signal into pulsating direct current, the audio component of which is filtered out by the networks including the condensers 27, 28, 29 and 30 into substantially direct current. This direct current flowing through the

resistor 50 develops a negative potential proportional to the incoming signal due to the potential drop in the resistor 20. This negative potential is applied through resistors 31, and 32, transformer winding 33, to the control grid 34 of the vacuum tube 7 in the radio frequency stage. It is well known that such a change in the biasing potential on the control grid of a vacuum tube in an amplifying stage serves to change the amplification effected in such a stage in accordance with such changing potential. Similarly, this biasing potential is applied over conductor 35 through resistor 36 and the secondary transformer winding 37, to the control grid 39 of the vacuum tube 8 in the first detector. This biasing potential likewise regulates the amplification effected in the first detector. While this regulating potential has been disclosed as applied to the control grids of two vacuum tubes of a radio receiver, the invention is not limited to such a specific arrangement, but the desired sensitivity control may be effected in one or more vacuum tube stages in accordance with the degree of control desired.

The output circuit of the second detector previously described as including the primary winding of the audio transformer 24, is coupled by means of this transformer to an audio stage including two vacuum tubes 40 and 41 which are connected in opposition, or as more commonly referred to, in push-pull. The output of this audio stage is linked by means of an audio transformer 42 to a loud speaker LS which may be of any well-known type.

The circuit diagram of the present disclosure with the exception of the loud speaker and a suitable power device for supplying the A current or heating current as well as the 180 volt course, represents the detailed circuits of a radio receiver. However, these circuits have not been described in detail but are shown to give a proper setting for the invention. It will be understood however, that condensers 43, 44 and 45 are tuning condensers which have their rotor units mounted on a single adjustable shaft to effect a proper tuning of the radio receiver.

In Fig. 2 there is shown a modified form of second detector which may be substituted for the circuit network of Fig. 1 included between the broken lines. This form of second detector like that previously referred to, effects the translation of the amplified radio frequencies or intermediate frequencies into the audio frequencies with a substantial translation gain. While the previously mentioned detector effects detection by so called plate rectification, that effected in the circuit network in Fig. 2 is of the type referred to as grid detection. In the operation of this circuit network, amplified incoming signals at either radio frequencies or intermediate frequencies are introduced through the transformer 11 into the input circuit of the second detector including the five-element vacuum tube 12. This input circuit may be described as including the cathode 16, the secondary winding 19 of the transformer 11, which winding is bridged by the condenser 52, resistor 53, grid leak 54 and grid condenser 55 in parallel, and control grid 15. The output circuit of this detector includes the screen 14, inductance 56, primary winding of the transformer 24, through the 180 volt source, ground conductor 25 and thence through resistor 53, secondary winding 19 to the cathode 16. This output circuit is linked by the transformer 24 to the audio amplifier including the vacuum tubes such as 40 and 41, shown in Fig. 1. In order to control automatically the degree of amplification of an incoming signal in one or more of the stages preceding the second detector, the carrier wave component of the incoming signal is also rectified in a portion of the network including the vacuum tube 12. In this instance, the cathode 16 and the anode 13 serve to rectify the carrier component thereof in a circuit extending from the anode 13, resistor 57, ground conductor 25 and thence to the cathode 16. The rectified carrier wave flowing through the resistor 57 develops a drop in potential which is applied through the resistor 31 and the conductor 35 to the control grid or grids of one or more of the amplifying stages preceding the second detector in a manner already described in connection with Fig. 1. The capacitor 58 co-operates with the resistor 57 to filter out the audio component of the rectified carrier wave and the resistor 31 with the condenser 59 serves further to filter out any undesired audio component.

While the present invention has been shown as incorporated in a radio receiver of the superheterodyne type, it is equally applicable to other type of radio receivers including those of the tuned and untuned radio frequency types. From the foregoing it will be understood that applicant has invented a detector in which a portion thereof translates an incoming signal into audio frequencies with a substantial translation gain and in which a portion of the detector develops a regulating potential which is utilized to control automatically the sensitivity of a radio receiver whereby substantially uniform signal volume is developed.

What I claim is:

1. In a radio receiver utilizing a single heated source of electron emission for a plurality of electron paths, the method of reproducing radio frequency signals into perceptible condition at uniform volume which comprises, amplifying said signals above audibility, translating said amplified signals into audio frequency signals with a substantial translation gain through one of said electron paths, rectifying a component of said amplified signals through another of said paths, utilizing said rectified signal component in regulating the amplification of the signals above audibility, and translating said audio frequency signals into perceptible condition.

2. In a radio receiver utilizing a single heated source of electron emission for a plurality of electron paths, the method of reproducing radio frequency signals into perceptible condition at uniform volume which comprises, amplifying said signals above audibility, translating said amplified signals into audio frequency signals with a substantial translation gain through one of said electron paths, rectifying a component of said amplified signals through another of said paths, filtering said rectified component to eliminate a substantial pulsating component therefrom, developing from said rectified and filtered component a regulating potential, utilizing said potential to regulate the amplification of signals above audibility, and translating said audio frequency signals into audible signals.

3. In a radio receiver including an amplifier having means to regulate the degree of amplification to be effected therein determined by a biasing potential, and a detector of the electron discharge type utilizing a single heated source of electron emission for a plurality of electron paths, the method of reproducing radio frequency sig-

nals into perceptible condition at uniform volume which comprises, amplifying signals above audibility, utilizing one electron path to translate said amplified signals into audio frequency signals and to amplify the same, also utilizing another electron path to rectify the carrier wave component of the first-mentioned amplified signals, employing said rectified carrier wave component to develop a biasing potential, applying said biasing potential to regulate the signal amplification effected above audible frequencies, and translating said audio frequency signals into perceptible condition.

4. In a radio receiver including an amplifier provided with means to regulate the degree of amplification to be effected therein as determined by a biasing potential, and a detector of the electron discharge type utilizing a single heated source of electron emission for a plurality of electron paths, the method of reproducing radio frequency signals into perceptible condition at uniform volume which comprises, amplifying signals above audibility, utilizing one electron path to translate said amplified signals into audio frequency signals with an appreciable translation gain and utilizing another electron path to rectify the carrier wave component of the amplified signal, employing said rectified carrier wave component to develop a biasing potential, and applying said biasing potential to said amplifier to regulate the amplification effected therein, and translating said audio frequency signals into perceptible condition.

5. In a radio receiver including an amplifier for amplifying radio frequency signals, said amplifier having means to regulate the degree of amplification effected therein as determined by a biasing potential, and a detector of the thermionic type utilizing a single heated source of electron emission for a plurality of electron paths, the method of reproducing radio frequency signals into perceptible conditiion at uniform volume which comprises, amplifying said signals above audibility, developing electron emission from said source, utilizing a portion of said electron emission in one path to translate said amplified signal into audio frequency signals and to amplify the same, utilizing another portion of said electron emission in another path to develop a rectified current corresponding to the carrier wave component of said first-mentioned amplified signals, employing said rectified current to generate a biasing potential, utilizing said biasing potential to regulate the amplification of said first-mentioned signals, and translating said audio frequency signals into perceptible condition.

6. In a radio receiver, an amplifying stage including a vacuum tube operating to amplify signals at frequencies above audibility, a detector having a vacuum tube provided with a first electrode, a second electrode, a third electrode, and a cathode, an input circuit for said detector linked to said amplifier, said input circuit including said cathode and one of said electrodes, an output circuit including said cathode and another of said electrodes, a rectifier circuit including a portion of said input circuit, an additional one of said electrodes and said cathode, said rectifier circuit serving to rectify the carrier component of said amplified signal, means for developing a potential according to said rectified carrier component, and means for utilizing said potential to control the amplification effected in said amplifying stage.

7. In a radio receiver, an amplifying stage including a vacuum tube operating to amplify signals at frequencies above audibility, a detector including a vacuum tube, having a first electrode, a second electrode, a third electrode and a cathode, an input circuit for said detector linked to said amplifying stage by a transformer, said input circuit including said cathode, the secondary winding of said transformer and said first electrode, said third electrode being connected to said first electrode through a capacitance, means for biasing said third electrode, an output circuit including said second electrode and said cathode, a resistor in said input circuit, and means for applying a negative potential developed by said resistor to control the amplification effected in said amplifier.

8. In a radio receiver, an amplifying stage, including a vacuum tube operating to amplify signals at frequencies above audibility, a detector having a vacuum tube provided with electrodes including an anode, a screen, a control grid and a cathode, an input circuit for said detector linked to said amplifier by a transformer, said input circuit including said cathode, the secondary winding of said transformer, a grid leak and a grid condenser in parallel and said control grid, an output circuit for said detector including said screen and said cathode, a rectifier circuit including said cathode, a portion of said input circuit and said anode, means in said rectifier circuit for developing a potential varying in accordance with the rectified current therein, and means for applying said potential to the control grid of said amplifier.

9. In a radio receiver, an amplifying stage including a vacuum tube operating to amplify signals at frequencies above audibility, a detector having a vacuum tube provided with electrodes including an anode, a screen, a control grid and a cathode, an input circuit for said detector linked to said amplifier by a transformer, said input circuit including said cathode, the secondary winding of said transformer, a grid leak and a grid condenser in parallel and said control grid, an output circuit including said screen and said cathode, a rectifier circuit including said cathode, a portion of said input circuit and said anode, said input circuit including a capacitance bridged across the terminals of said secondary winding to tune said input circuit, means in said rectifier circuit for developing a potential varying in accordance with the rectified current therein, and means for applying said potential to the control grid of said amplifier.

10. In a radio frequency signaling system, means for amplifying signals at frequencies above audibility, means including one heated electron source for translating said amplified signals into audio frequency signals with a substantial translation gain, means including said heated electron source for rectifying a component of said amplified signals, means controlled by said rectified signal component and including a portion of said amplifying means for regulating the amplification effected by said amplifying means, and means for reproducing said audio frequency signals into perceptible form.

11. In a radio frequency signaling system, means for amplifying signals at frequencies above audibility, means including one heated electron source for translating said amplified signals into audio frequency signals with a substantial translation gain, means including said heated electron source for rectifying a component of said amplified signals, means for filtering said rectified signal component, means controlled by said filtered

signal component and including a portion of said amplifying means for regulating the amplification effected by said amplifying means, and means for reproducing said audio frequency signals into perceptible form.

12. In a radio frequency signaling system, means for amplifying signals at frequencies above audibility under the control of a biasing potential, means including one heated electron source for translating said amplified signals into audio frequency signals with a substantial translation gain, means including said heated electron source for rectifying a component of said amplified signals, means controlled by said rectified signal component for controlling the biasing of said amplifying means whereby the amplification effected by said amplifying means is regulated, and means for reproducing said audio frequency signals into perceptible form.

VIRGIL M. GRAHAM.

DISCLAIMER

1,971,605.—*Virgil M. Graham*, Rochester, N. Y. SIGNALING SYSTEM. Patent dated August 28, 1934. Disclaimer filed May 31, 1936, by the assignee, *Stromberg-Carlson Telephone Manufacturing Company*.

Hereby enters this disclaimer as to claims 1, 2, 3, 4, 5, 6, 10, 11, and 12 of said patent.

[*Official Gazette April 21, 1936.*]

signal component and including a portion of said amplifying means for regulating the amplification effected by said amplifying means, and means for reproducing said audio frequency signals into perceptible form.

12. In a radio frequency signaling system, means for amplifying signals at frequencies above audibility under the control of a biasing potential, means including one heated electron source for translating said amplified signals into audio frequency signals with a substantial translation gain, means including said heated electron source for rectifying a component of said amplified signals, means controlled by said rectified signal component for controlling the biasing of said amplifying means whereby the amplification effected by said amplifying means is regulated, and means for reproducing said audio frequency signals into perceptible form.

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