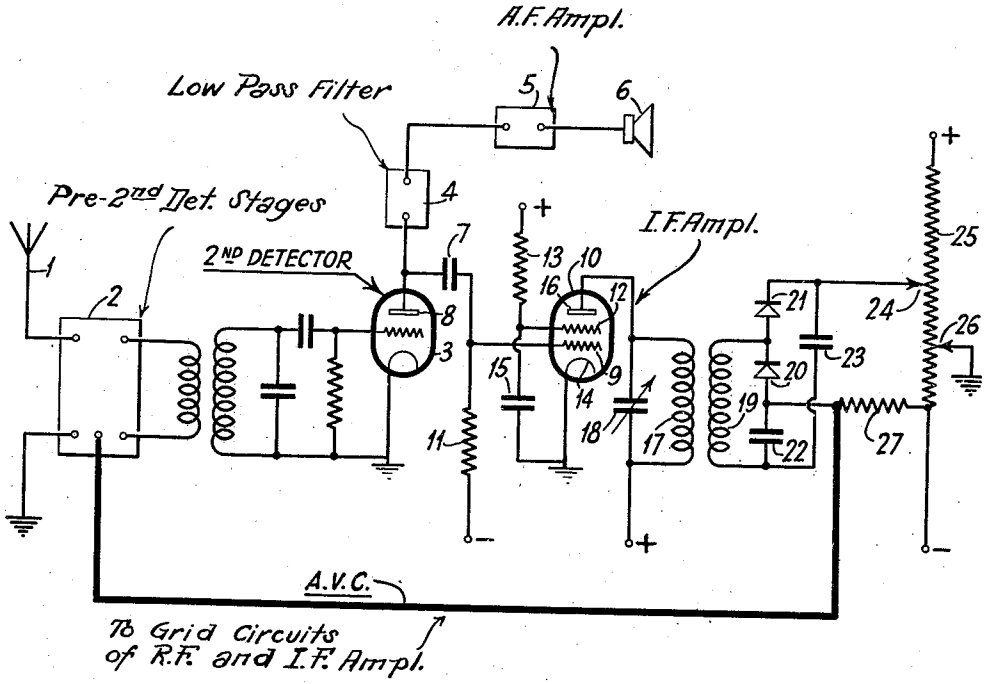
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DELAYED AUTOMATIC GAIN CONTROL CIRCUIT

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DELAYED AUTOMATIC GAIN CONTROL CIRCUIT

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This invention relates to modulated carrier wave receivers and more particularly to receivers of the type employing automatic gain control means, i. e. to receivers of the type wherein means are provided for automatically varying the gain of a carrier frequency stage or stages therein in such manner as to tend to maintain the reproduced signal strength approximately constant despite variations in received signal strength. Such automatic gain control means are commonly provided in radio receivers for the purpose of minimizing the effects of fading and for similar purposes.

The object of the invention is to provide an improved automatic gain control arrangement whereby a large range of gain control with so-called "delayed" gain control action can be obtained and which shall at the same time be very simple and relatively inexpensive.

According to this invention an automatic gain control arrangement for a radio or like modulated carrier wave receiver comprises in combination means for taking carrier frequency energy from a desired stage in the receiver, means including a voltage multiplying rectifier arrangement for rectifying said carrier frequency energy (if desired after said energy has been amplified) and a potentiometer resistance arrangement associated with the voltage multiplying rectifier arrangement and also with the valve or valves whose gain is to be controlled, and the whole circuit being such that until the rectified voltage set up in the voltage multiplier arrangement reaches a predetermined minimum value the bias applied to the valve or valves to be controlled in gain is a normal bias determined by the point of connection with the potentiometer, but when the voltage set up in the said voltage multiplier rectifier arrangement exceeds said minimum the said normal bias is augmented and the gain of the said valve or valves is thereby automatically reduced as the received signal strength increases.

A preferred embodiment of the invention as applied to a superheterodyne receiver will now be described with reference to the accompanying drawing.

Referring to the drawing a superheterodyne receiver comprises the usual receiving aerial 1 followed as in the customary way by a frequency changer or first detector in turn followed by an intermediate or beat frequency amplifier which feeds into a second or demodulating detector. If desired a radio frequency amplifier may be interposed between the aerial and the frequency changer. The carrier stages of the receiver, i. e. those including the valves preceding the demodulating detector may all be as known per se and in the drawing are represented simply by the rectangle 2 which is also presumed to include the necessary local oscillation source. The output from the demodulating detector valve 3 is divided into two channels one of which passes the low or modulating frequency components and the other the carrier or intermediate frequency component. The former channel, which includes a low pass filter of any convenient design represented by a rectangle 4 leads as in the usual way, to the normally provided audio frequency amplifier 5 and reproducing apparatus 6 of the receiver. As the apparatus at 4, 5 and 6 may be all as well known, per se, it is represented in highly simplified schematic form with single lines representing the channel from valve 3 through filter 4 and amplifier 5 to reproducer 6. The other channel includes a coupling condenser 7 which couples the anode 8 of the demodulating detector 3 to the control grid 9 of an additional intermediate frequency amplifier valve 10, preferably constituted as shown by a screened grid valve. The control grid 9 receives suitable negative bias through a grid resistance 11 and the screen grid 12 receives suitable positive bias through the usual screen grid resistance 13, the said screen grid being connected to the cathode 14 through a by-pass condenser 15. Anode potential is applied to the anode 16 of the screened grid valve 10 through the primary 17 of a transformer said primary being tuned to the intermediate frequency by a shunt condenser 18.

The secondary 19 of the transformer feeds into a voltage doubling rectifier arrangement preferably comprising, as shown, two crystal type or copper oxide rectifiers 20, 21, in series. The junction point between these two rectifiers is connected to one end of the secondary 19 the other end of said secondary being connected through one condenser 22 to the remaining terminal of one rectifier 20 and through another condenser 23 to the remaining terminal of the other rectifier 21. The "positive" end of the two series rectifiers is connected to a tapping point 24 upon a potentiometer resistance 25, one end of which is maintained at some suitable positive potential (for example about 130 volts) and the other end of which is connected to some suitable point of low or negative potential (for example—10 volts). These potentials are relative to the earth or cathode potential for the receiver, as a whole, there being an earthed tapping point 26 upon the potentiometer resistance 25 at such position as will

result in the two ends (marked + and −) of said resistance having the required potentials. The negative end of the potentiometer resistance 25 is connected through a further resistance 27 to the "negative" and of the two series rectifiers 20, 21 and also through a lead AVC to the low potential end or ends of the grid circuit or circuits (not separately shown) of the carrier frequency valve or valves (radio frequency valves and/or intermediate frequency valves) at 2 to be controlled in gain.

It will be seen that with this arrangement until the voltage set up in the rectifier circuit exceeds the total voltage between the tapping point 24 and the negative end of the potentiometer 25 no current flows through the automatic gain rectifier and there will be no automatic gain control action. In these circumstances the bias of the valve or valves being controlled in effect depends upon the relative values of the resistance 27 and the "reversed" or "back" resistances of the rectifiers 20 and 21 in series. When, however, the voltage induced in the rectifier circuit rises beyond the predetermined minimum—the value of which will depend upon the positions of the tappings on the potentiometer resistance—the normal bias is augmented and the required gain control action will be obtained, increased negative potential being applied to the grids to be controlled as the received signal strength increases. It will be observed that, despite the simplicity of the circuit arrangement, an amplifier valve (valve 10) is provided for amplifying the carrier frequency energy from which the gain controlling potentials are to be derived; there is voltage doubling of the rectifier potentials used for gain control; and there is a "delay" action which can be controlled without affecting the normal or standard grid bias of the valve or valves to be controlled.

What I claim is:

1. In a radio receiver of the type employing at least one signal transmission tube and an automatic volume control circuit therefor, said control circuit comprising a pair of rectifiers in series, a direct current voltage supply source, an impedance across said source providing a potentiometer, means establishing an intermediate point of said impedance at a fixed potential, connections from opposite terminals of the rectifiers to points on the impedance which are respectively positive and negative with respect to the said fixed point, a connection from the transmission tube control electrode to the negative terminal of said series rectifiers, and means for impressing received signal energy between the junction of the rectifiers and each of said opposite terminals.

2. A modulated carrier wave receiver of the type including at least one carrier wave transmission tube and a delayed automatic gain control circuit, said control circuit comprising a pair of rectifiers arranged in series, a carrier input circuit having one side thereof connected to the junction of the rectifiers and its other side to each of the opposite terminals of the rectifiers thereby to provide a voltage multiplying rectifier network, means establishing one of said opposite terminals at a positive potential with respect to the other terminal thereby to prevent rectification until the carrier amplitude exceeds a predetermined value, and means connecting a gain control electrode of said transmission tube to the negative one of said terminals whereby said rectifier network provides a gain reducing bias for the transmission tube when said carrier amplitude value is exceeded.

3. A modulated carrier wave receiver of the type including at least one carrier wave transmission tube and a delayed automatic gain control circuit, said control circuit comprising a pair of rectifiers arranged in series, a carrier input circuit having one side thereof connected to the junction of the rectifiers and its other side to each of the opposite terminals of the rectifiers thereby to provide a voltage multiplying rectifier network, means establishing one of said opposite terminals at a positive potential with respect to the other terminal thereby to prevent rectification until the carrier amplitude exceeds a predetermined value, and means connecting a gain control electrode of said transmission tube to the negative one of said terminals whereby said rectifier network provides a gain reducing bias for the transmission tube when said carrier amplitude value is exceeded, said connecting means including connections to said first means to provide a normal bias for said control electrode.

4. A modulated carrier wave receiver of the type including at least one carrier wave transmission tube and a delayed automatic gain control circuit, said control circuit comprising a pair of rectifiers arranged in series, a carrier input circuit having one side thereof connected to the junction of the rectifiers and its other side to each of the opposite terminals of the rectifiers thereby to provide a voltage multiplying rectifier network, means establishing one of said opposite terminals at a positive potential with respect to the other terminal thereby to prevent rectification until the carrier amplitude exceeds a predetermined value, and means connecting a gain control electrode of said transmission tube to the negative one of said terminals whereby said rectifier network provides a gain reducing bias for the transmission tube when said carrier amplitude value is exceeded, and a carrier transmission network between the transmission tube output and said rectifier input circuit.

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