

July 12, 1932.

H. J. J. M. DE R. DE BELLESCIZE 1,867,139

RADIO RECEIVING APPARATUS

Original Filed March 30, 1927

Fig. 1

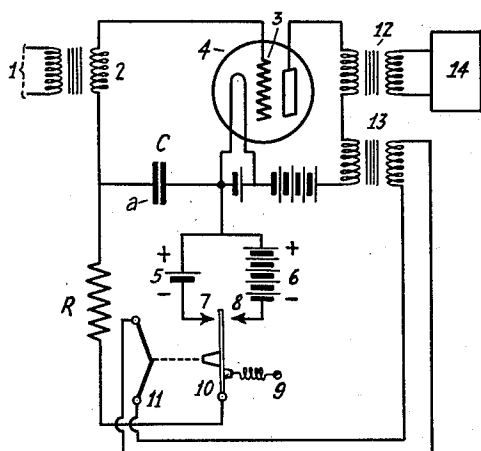


Fig. 2

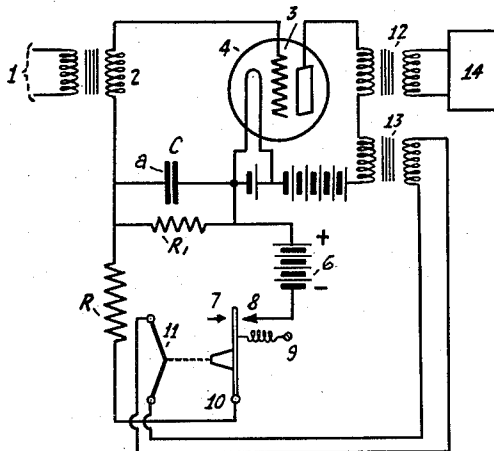
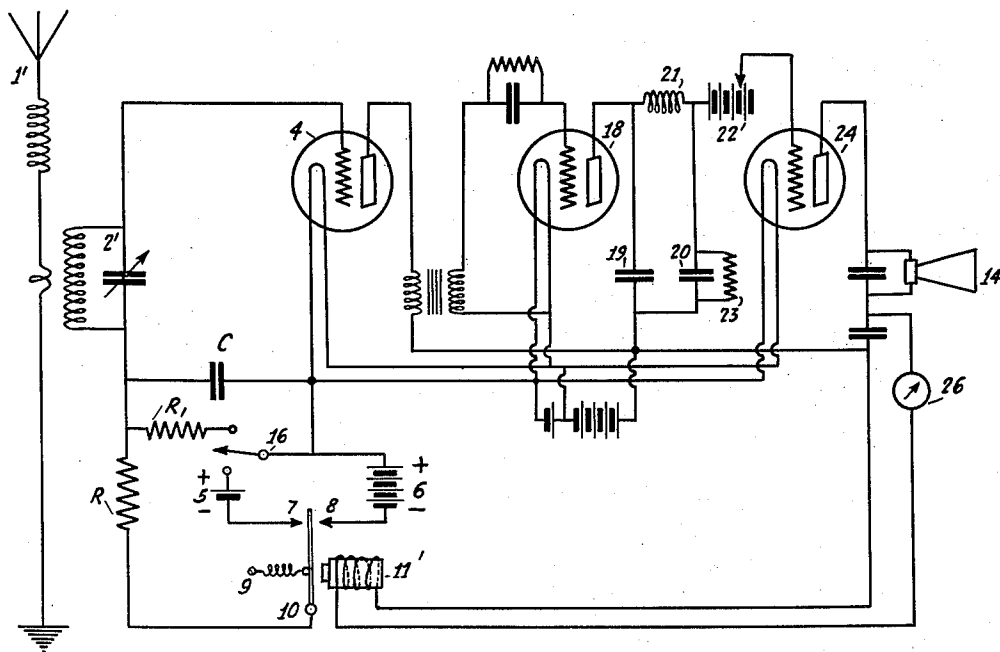


Fig. 3



INVENTOR

H. J. J. M. de R. de BELLESCIZE

BY *J. J. Adams*
ATTORNEY

UNITED STATES PATENT OFFICE

HENRI JEAN JOSEPH MARIE DE REGNAULD DE BELLESCIZE, OF PARIS, FRANCE, ASSIGNOR TO RADIO CORPORATION OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

RADIORECEIVING APPARATUS

Application filed March 30, 1927, Serial No. 179,469, and in France April 13, 1926. Renewed September 16, 1930.

This invention relates to receiving apparatus and more particularly to an arrangement associated therewith for compensating the effects due to fading.

5 In certain equipments fed with alternating current or alternating current potentials of sinusoidal wave form, either modulated or periodically interrupted, it happens on account of certain accidental causes that the
10 current or the alternating current potential is subject to more or less great variations in amplitude. Now, it is often necessary, with a view to preserve the apparatus, for the sake of regulation or simply of the quality
15 of reproduction, that the indicator apparatus should carry a current which, while faithfully reproducing the modulations or interruptions of the feed currents or potentials, is entirely freed or safeguarded from
20 accidental variations of its mean amplitude.

Among such cases in which this problem arises, there figures chiefly that of transmission with Hertzian waves subject to what is known as fading.

25 The present invention discloses a solution to the problem which is useful for distribution by alternating current both permanent as well as modulated or periodically interrupted, provided that the frequency of modulation or interruptions should be higher
30 than that of accidental alterations, when this condition is mostly fulfilled. In the case of direct current distribution, it would be sufficient to change first into alternating current by the aid of a converter of well-known kind.

It has already been suggested to interpose between the supply and the indicator a coupling means whose sensitiveness diminishes automatically as soon as the current in the
40 indicator exceeds a certain pre-arranged value, and this reduction was ordinarily insured by the aid of a variable resistance. The inconvenience residing in devices of this kind consists in that to each value of the current in the indicator there corresponds one
45 and only one value of the variable resistance, and therefore of the sensitiveness of the coupling means.

50 However, it is necessary, and this is accomplished by the present invention, that

every increase or decrease, no matter how small in amount of the mean current or potential in the indicator, should be compensated by an increase or a decrease in sensitiveness of sufficient value in order to compensate for the slight departure that has given rise thereto. It is moreover desirable, once that the mean current in the indicator has been restored to the desired value, that the sensitivity of the transmission should be fixed to a predetermined value instantaneously assumed in order to insure such result, and this, until a fresh change in the supply current or potential occurs.

In other words, the supply current and current in the indicator should be connected by a transmission device acting similarly as a servo-motor.

The invention, both as to its construction and mode of operation together with the objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawing in which

Fig. 1 is a circuit arrangement embodying the features of my invention,

Fig. 2 is a modification thereof, and

Fig. 3 is an arrangement applying the schemes shown in Figs. 1 and 2 to Hertzian wave receivers for the purpose of compensating the effects due to fading.

The scheme shown in Fig. 1 is especially adapted to regulation of sinusoidal currents or signals on carrier waves. The current coming in at 1 actuates an indicator 14 through the intermediary of transformer 2, relay 4 and transformer 12, the latter coupling the output of relay 4 and indicator 14. The relay 4 may be, for instance, an arc relay, or a vacuum tube, comprising one or more control electrodes. The sensitiveness of the relay depends upon the permanent potential applied to one of its electrodes 3, the said potential being derived from the plate *a* of condenser C, the charge of which therefore governs the sensitivity. In order that this charge may assume or preserve a convenient value at all instants, the condenser C is fed across a resistance R from one of the two sources 5 or 6 cut in the circuit by means of a mobile con-

tact or armature 10 adjusted by a spring 9 and bearing upon one of the contacts 7 or 8. The connection in circuit of the source 5 for a sufficiently long time imparts a maximum of sensitivity to the relay, while when source 6 is connected in circuit, the sensitivity is considerably diminished. (In the majority of relays, the maximum sensitivity is obtained by replacing the source 5 by a conductor connecting the contact 7 with the relay). The movable contact or armature 10 in turn is controlled by the output current of the relay through transformer 13. If the mean value of this current is unduly low, the armature will come to bear upon contact 7, and this results in a gradual increase in sensitivity to such an amount as may be required. If the current in the indicator is too high, the armature comes to bear upon contact 8 with the incidental result that the sensitivity is diminished. Finally, if the current preserves its pre-arranged value, the armature having but a small stroke or travelling distance, remains between contacts 7 and 8 so that the sensitivity remains unaltered, save for the losses occasioned in condenser C. By way of example, there is shown for the drive 11—9 of armature 10 a device of known kind adapted to thermal ammeters which by contacts 7—8 allows of regulation of the main valve of the current received by the indicator. Similarly as in a servo-motor, it is possible in this scheme to adjust the rate of variation of sensitivity by adjusting the time constant RC. This time constant must be considerably higher than the time of shift of contact 10, while it must be lower than the period of accidental alterations to be compensated.

Fig. 2 shows a modification adapted to the regulation of periodically interrupted currents such as the currents used in telegraphy work. For this purpose, the source 5 is omitted and the condenser C is shunted by a resistance R' appreciably higher than the resistance R. As long as the current coming from the relay 4 is too low, the movable contact or armature 10 will never reach the contact 8 and the condenser C will get a chance to discharge completely into the resistance R' whereby the sensitiveness of the relay is gradually increased to a maximum. On the contrary, in the course of transmission by unduly intensive signals, the armature 10 is incessantly in movement passing from contact 7 during spaces between signals to contact 8 while signals are proceeding. Hence, alternating discharges and charges take place in the condenser C, the latter changing it suddenly on account of the relation R' and R. This differential action makes the relay gradually insensitive until the armature 10 no longer reaches the contact 8.

Fig. 3 illustrates an application of this regulator to a receiver acted upon by Hert-

zian waves and here shown only in its most elementary parts for the sake of clarity of illustration.

The signals on modulated or chopped waves are received by the antenna 1' and the tuned circuit 2', thence fed to the regulator tube 4, and thereafter detected by tube 18. If at this point, their intensity is not yet sufficient to actuate the armature 10, they may be amplified by one stage for direct current, comprising in well-known manner a relay 24, a plate resistance 23 and a source 22, capacities 19—20 and the coil 21 stopping the flow of radio frequency oscillations to the relay 11' the proximity of which to tube 4 is liable to occasion oscillations. The relay 11' may be of any desired type, for instance, of the moving coil type, and it is passed by a current $I_p + I_s$, (plate current and signal current, respectively). By tensioning more or less the spring 9 or shifting the row of contacts 7—8, it is possible to cause contact 7 to become operative for any desired value of the current less than the pre-arranged value $I_p + I_s$, and contact 8 for all higher values. A reverser 16 (commutator switch) allows of changing operating conditions from reception on carrier waves to operation and reception on broken waves. A milliammeter 26 is provided to insure proper operation. The indicator is shown at 14' coupled capacitively to the output of relay 24.

By virtue of the automatic feature of the regulation here disclosed, it is possible for the receiver apparatus to handle signals of widely varying volumes without the necessity of manipulation of any kind, regardless of whether the corresponding station is located a few kilometers or a few thousand kilometers away.

This regulating device is indispensable to insure proper function of certain parts of receiving equipment, for instance, in the operation of the differential arrangement comprising frictional means disclosed in the French Patent No. 587,625 filed December 28, 1923; indeed, in the absence of such protective means, the excess of energy coming in on the signal at any given time is apt to derange the differential device. And when allowed to go too far, such excess of energy may even cause disappearance of the signals, according to the mechanism provided for disturbance and interference.

It must be noted that the present invention comprises all modifications, servo-motors, static elements, and other, adapted to automatically vary the sensitivity in the desired sense, in a continuous or intermittent manner, until the pre-arranged value for the indicator is restored.

Having thus described my invention, I claim:

1. Radio receiving apparatus of the class described, comprising a high frequency am-

plifier, an electromechanical relay controlled by the output of said amplifier, said relay having an armature connected to the control electrode of the amplifier, and a pair of contacts raised to different potentials arranged to cooperate with said armature, whereby variations in mean signal intensity will actuate the relay armature to contact with one or the other of said contacts to maintain the signal intensity substantially constant.

2. Radio receiving apparatus of the class described, comprising a thermionic amplifier, indicating means coupled to the output thereof, and means for compensating for any variation in mean signal intensity in said indicating means comprising an electromechanical relay coupled to the amplifier output, a condenser connected between cathode and control electrodes of the amplifier, said relay having an armature connected to one terminal of the condenser, and a pair of contacts and polarizing means connected to the other terminal of the condenser, the relay armature normally assuming a position intermediate said contacts and contacting with one or the other thereof when the signal intensity in the amplifier output is above or below the mean signal intensity.

3. Radio receiving apparatus of the class described, comprising a high frequency amplifier, indicating means coupled to the output thereof, and means for compensating for any variation in mean signal intensity in said indicating means comprising an electromechanical relay coupled to the amplifier output, a condenser connected between cathode and control electrodes of the amplifier, said relay having an armature connected to one terminal of the condenser through a resistance, and a pair of contacts and grid polarizing means connected to the other terminal of the condenser, the relay armature normally assuming a position intermediate said contacts and contacting with one or the other thereof when the signal intensity in the amplifier output is above or below the mean signal intensity.

4. In radio receiving apparatus of the class described, the combination with a high frequency amplifier, of an indicator coupled to the output of said amplifier, and means for compensating for any variation of the mean signal intensity in the indicator, said means comprising a condenser connected between cathode and control electrodes and an electromechanical relay controlled by the amplifier output for charging said condenser in proportion to resulting variations, said condenser charge arranged to influence the control electrode for maintaining the mean signal intensity substantially constant.

5. Apparatus for maintaining the output of an electron discharge device substantially constant despite fading fluctuations in the input thereof comprising, an electron discharge device having an anode, a cathode and a con-

trol electrode; input and output circuits coupled thereto; means responsive to the output for applying a control potential to the control electrode of the electron discharge device; and means for controlling the time at which the applied control potential makes itself manifest upon the control electrode.

6. Apparatus for maintaining the output of an electron discharge device substantially constant despite fading fluctuations in energy supplied to the input thereof comprising, an electron discharge device having an anode, a cathode, and a control electrode; input and output circuits coupled thereto; means for controlling the amplification of the device inversely to the average amplitude of the output thereof; and means for controlling the speed of action of the said last mentioned amplification control means.

7. Apparatus for maintaining the output of an electron discharge device substantially constant despite fading fluctuations in the input thereof comprising an electron discharge device having an anode, a cathode, and a control electrode; input and output circuits coupled thereto; means for utilizing a portion of the energy in the output circuit for maintaining the output energy constant despite fluctuations in the energy in the input circuit; and means for controlling the time at which energy taken from the output circuit for maintaining the output energy relatively constant, acts.

8. The method of automatically varying the sensitivity of a high frequency amplifier inversely to variations of intensity of received signals applied to the input circuit of the amplifier which includes capacitively storing electrical energy, impressing potentials derived from the capacitively stored energy of appropriate values on the control electrode of the amplifier to compensate for any change in the mean value of the currents in the output of said amplifier; the value of the impressed potentials being determined by the amplifier output.

9. Apparatus for maintaining the output of a high frequency amplifier including an electron discharge tube substantially constant despite fading fluctuations in the input thereof, said tube having an anode, a cathode and a control electrode, input and output circuits coupled thereto, a path including a visual current indicator and means responsive to the amplifier output for applying a control potential to the control electrode of said tube, and means for controlling the time at which the applied control potential makes itself manifest upon the control electrode.

10. Apparatus for maintaining the output of an electron discharge device substantially constant despite fading fluctuations in energy supplied to the input thereof comprising an electron discharge device having an anode, a cathode, and a control electrode input and

output circuits coupled thereto, a path including a visual current indicator and means for controlling the amplification of the device inversely to the average amplitude of the output thereof, and means for controlling the speed of action of the said last mentioned amplification control means.

11. In a high frequency receiving system, an electron discharge device having an anode circuit, a cathode and a grid, a tuned circuit connected between said cathode and grid whereby said receiving system may be adjusted to respond to current of a desired frequency, sound reproducing means, means for supplying current from said device to said sound reproducing means, means for controlling the static potential on said grid in response to the intensity of the received carrier thereby to produce a substantially constant volume of sound from said sound reproducing means over a range of intensities of received current, means responsive to the magnitude of current flowing in said anode circuit for visually indicating said magnitude, and additional means for controlling the time at which the static potential makes itself manifest on said grid.

12. In combination, in a radio receiver, a high frequency amplifier having a resonant input circuit, a detector having its input electrodes coupled to the output circuit of said amplifier, a reproducer, means for connecting the reproducer to the output of said detector, a path connecting said detector output to said resonant circuit of said amplifier, said path including a resistor for controlling the static potential on the grid of the amplifier in response to the intensity of received current thereby to produce a substantially constant volume of sound from said reproducer over a range of intensities of received current, a condenser connected to said resistor in the input circuit of said amplifier, said condenser having a magnitude such that the time at which the said static potential makes itself manifest on said grid is controlled, and a visual current indicator connected to said aforementioned path.

HENRI JEAN JOSEPH MARIE de

REGNAULD de BELLESCIZE.

DISCLAIMER

1,867,139.—*Henri Jean Joseph Marie de Regnauld de Bellescize*, Paris, France.
RADIO RECEIVING APPARATUS. Patent dated July 12, 1932. Disclaimer filed
September 30, 1933, by the assignee, *Radio Corporation of America*.

Hereby enters this disclaimer to the said claims of said Letters Patent which
are in the following words, to-wit:

"5. Apparatus for maintaining the output of an electron discharge device
substantially constant despite fading fluctuations in the input thereof comprising,
an electron discharge device having an anode, a cathode and a control electrode;
input and output circuits coupled thereto; means responsive to the output for apply-
ing a control potential to the control electrode of the electron discharge device; and
means for controlling the time at which the applied control potential makes itself
manifest upon the control electrode.

"6. Apparatus for maintaining the output of an electron discharge device
substantially constant despite fading fluctuations in energy supplied to the input
thereof comprising, an electron discharge device having an anode, a cathode, and a
control electrode; input and output circuits coupled thereto; means for controlling the
amplification of the device inversely to the average amplitude of the output thereof;
and means for controlling the speed of action of the said last mentioned amplification
control means.

"7. Apparatus for maintaining the output of an electron discharge device sub-
stantially constant despite fading fluctuations in the input thereof comprising an
electron discharge device having an anode, a cathode, and a control electrode; input
and output circuits coupled thereto; means for utilizing a portion of the energy in the
output circuit for maintaining the output energy constant despite fluctuations in the
energy in the input circuit; and means for controlling the time at which energy taken
from the output circuit for maintaining the output energy relatively constant, acts.

"8. The method of automatically varying the sensitivity of a high frequency
amplifier inversely to variations of intensity of received signals applied to the input
circuit of the amplifier which includes capacitively storing electrical energy, impres-
sing potentials derived from the capacitively stored energy of appropriate values on
the control electrode of the amplifier to compensate for any change in the mean value
of the currents in the output of said amplifier; the value of the impressed potentials
being determined by the amplifier output."

[*Official Gazette October 31, 1933.*]