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RECEIVER FOR OBSERVING TWO
DIFFERENT SIGNALS

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This invention relates to a receiver arrange-
ment for distinct observation of the proportion
between two signals having different amplitudes.

There has been proposed a method of increas-
ing the proportion between two or a greater
number of different amplitudes in which the
threshold of response of the receiver arrangement
in relation to the size of the respective receiving
amplitude is so placed that it lies directly below
the highest amplitude. Since during the smaller
time length of signals the threshold of response
must remain in the position determined by the
greater amplitude, the time lag displacement will
be slowly carried out relative to the duration of
the signal. The time constant of the control must
in this case be large relative to the duration of
the signal, i. e., it must be essentially larger than
the longest time length of signal. Such arrange-
ments were found to be favorable in cases where
the absolute changes in the signal intensities
occur at slow speed.

The receiver arrangement for distinct observa-
tion of the proportion between two signals of
different time dimensions, according to the inven-
tion, is characterized in that the received signals,
after being applied across a preliminary input
amplifier stage, are applied to an amplifier auto-
matically controlling a constant level, and that
the time constant of the amplification control is
of the order of the shortest time length of signal
impulse.

The arrangement according to the invention
has the advantage that it functions properly also
in the case of input amplitudes having a sudden
change in value. Such sudden amplitudinal
changes are to be considered if due to bending,
reflexions, fading, etc., especially in case of short
waves, minimum fading bands appear in the
radiation field of the transmitter.

The main field of application of the present in-
vention is the direction finding of crafts. In the
majority of the guide ray methods two paths of
radiations having different code identifications
are sent out at the transmitter side under a cer-
tain angle to each other. At the receiver side
the relative location between receiver and trans-
mitter shall then be determined from the propor-
tion between the volume level of the signals. At
small differences in values in volume level be-
tween the individual signals it is difficult to recog-
nize the absolutely greatest signal with certainty.
The present invention offers a reliable means of
overcoming these difficulties by providing suitable
relay and indicating means such as, for example,

by having the different signal impulses light
lamps of different colors.

The present invention may eventually also
serve to the effect that for code reception (tele-
graphic signal reception) and simultaneous pres-
ence of a smaller disturbing amplitude, only the
absolute largest signal amplitude and desired sig-
nal causes the relay to respond. In the last-
mentioned case it is advisable, in order to elim-
inate the direct current component, to interpose
a transformer between the arrangement accord-
ing to the invention and the polarized relay.

In order to carry out the present invention, all
known circuit arrangements can be used as ampli-
fiers with automatic volume control. In most
cases the arrangement according to the invention
has a circuit element possessing a curved or bent
characteristic, and another element affording an
amplification. Ordinarily both requirements are
fulfilled by a tube arrangement. As circuit tube
elements with curved characteristic it is possible
to utilize any arrangement having a valve action
eventually employing a biasing potential, for
instance, dry-rectifier with preceding amplifiers
having automatic volume control. These indica-
tions are intended only to emphasize that the
carrying into practice of the idea of the inven-
tion is not limited to or bound up with the appli-
cation of any definite tube circuits.

Thus, for instance, one or several tubes in
audion connection may be employed in which
grid condensers and leakage resistors are so di-
mensioned that the time of control for setting the
self-excited biasing potential is of the order of
the shortest signal, that is, for example, in code
reception the dot and not the dash.

Furthermore, it is possible to use multi-grid
tubes such as fading-hexodes as amplifiers with
automatic volume control in the so-called elec-
tron-feed back circuit.

Amplifiers with automatic volume control may
also be employed in which the grid bias can be
varied across a special detector circuit. To this
end a control potential is derived from the output
circuit of the amplifier and which will be detected
and smoothed in a filter arrangement. The di-
rect potential thus obtained will be applied to
the grid circuit of one or several tubes of the
amplifier.

The functioning of the receiver arrangement
according to the invention will be explained with
reference to Figures 1 to 4 of the drawings, in
which:

Fig. 1 is a circuit of the receiver arrangement of
this invention;

Figs. 2 and 3 are curves of the voltage amplification of the letters "A" and "N";

Fig. 4 is a circuit diagram of a combination of relays.

Referring now in detail to the drawing:—

Figure 1 represents the circuit of a receiver arrangement according to the invention utilizing a control amplifier to which a control potential proportional to the amplifier output is applied to maintain the constant level.

The received signals are applied across a preliminary amplifier stage D to the input circuit E of an amplifier V with automatic volume control. To the grid circuit of the first tube V_1 and eventually to all tubes a control potential is applied whose value depends upon the output amplitude of the amplifier. To accomplish this end a part of the signal amplitude is derived from the output circuit A of the control amplifier V across a coupling coil O and after detection in a detector G and filtering out of the carrier frequency in a filter F it is applied to the grid circuit or grid circuits of the tubes V_1 , etc., as control potential.

The constants of the filter F must be so dimensioned that the time constant of the amplifier control is of the order of the shortest signal or dot. If the signals are a modulation of a carrier high-frequency, the stage D can be connected as detector. In case of non-modulated signals, the preliminary stage D may, if desired, be in the form of a high frequency heterodyne receiver amplifier with a local oscillator which beats with the carrier high frequency to give an audio signal response.

The functioning of a circuit according to Figure 1 shall be explained with reference to Figures 2 and 3. U_E represents the upper part of the enveloping curve of the alternating voltage amplitudes at the input circuit of the amplifier V, item U_A represents the upper part of the enveloping amplitude curve of the voltages appearing at the output circuit. The amplifier V is so adjusted that it controls on a constant level P. At the time t_1 the voltage U_E suddenly increases at dU_E whereby it increases from a value U_1 to a value U_2 . The amplifier V with automatic volume control having its degree of amplification adapted to the amplitude U_1 retains its degree of amplification at first and furnishes its increased output potential $U_A + dU_A$ (shown in dash lines). As a result thereof an increased or bias control potential U_R is produced reducing the total degree of amplification of V in such manner that at the output circuit A there again appears a potential U_A corresponding to the constant level P. When the input amplitudes are decreased from the value U_2 to the value U_1 the performance is reversed.

In order to render noticeable only the beginnings of the respective largest signals, the potential U_A is applied, for instance, to the grid circuit of a tube N having a highly negative bias and the latter is so adjusted that only the upper peaks of the potential U_A furnish a plate current, i. e., appear at the terminals K. In place of the tube N a biased or self-biasing dry-rectifier or similar valve may be used. The voltage peaks U_K shown in Figures 2b and 3b correspond to the beginnings of the signal elements belonging to the signal having the greatest amplitude. Thus only the beginnings of the signals will be signaled at terminal point K, so to say.

There may be connected to the terminals K of the tube N or of a corresponding valve, a reception indicator, such as for instance, a telephone, a pointer instrument, or a combination of relays for

releasing optical signals, as shown, for example, by the relays and light bulbs in Fig. 4.

The receiver arrangement according to the invention offers particular advantages in connection with methods of guiding sea-and air crafts, if at the transmitter side two radiations are sent out at an angle to each other, and the identifications of both radiations are chosen according to definite viewpoints. For the one radiation there may be chosen with advantage, the periods between the beginnings of the signal elements of a signal (of a group of signals), in such a manner that their duration is just that of the shortest signal. For the other radiation the identification signs will be chosen in such manner that they form complementary signs to the first radiation, and the periods between the beginnings of the signal elements of a signal be the combined duration of the short or dot and the longest or dash signal. Such signals are obtained, for instance, when keying one radiation in the rhythm of the Morse signal "a", and the other radiation in the rhythm of the Morse signal "n". These two signals have been used, for example, in the Figures 2a representative of the rhythm of Morse signal "a" and 3a representative of the rhythm of Morse signal "n". The Figures 2b and 3b clearly indicate the shapes or curves assumed by the individual signals when passing through the receiver arrangement according to the invention.

As indicators there may be connected to the terminals K of the blocking tube N, pointer instruments, telephones, or suitably dimensioned glow or incandescent tubes.

Figure 4 shows a combination of relays in conjunction with optical indicating apparatus (colored or clear bulbs).

The output terminals K of the tube N may have connected thereto the magnet windings of two relays M_1 , and M_2 for instance, placed in series or in parallel. The relay M_1 is so dimensioned and set that it responds to the current impulses with relatively rapid response, while the relay M_2 is so adapted that it responds with delay and will also be released with delay. The relay M_1 has a working contact n_1 and the relay M_2 has a working contact n_2 . In series to the working contact n_2 of the relay, there is placed the winding of a third relay M_3 having reversing means equipped with a working contact n_3 and a rest contact n_4 . The relay M_3 is so constructed and set that its release takes place with greater delay than that of relay M_2 . The working contact n_3 is connected to the battery B across a red bulb r and the rest contact n_4 across a green bulb g and furthermore across the working contact n_1 of the relay M_1 to the contact spring of the relay M_3 . Particulars regarding the circuit are seen from the drawing.

If the combination of relays is excited by potentials in accordance with the N impulses shown by Figure 3, only the relay M_1 responds closing a circuit from battery B across a green bulb g, rest contact n_4 of relay M_3 , and across working contact n_1 of relay M_1 . When exciting the relays, however, by potentials according to Figure 2b representative of A impulses, at the first voltage peak only relay M_1 responds. Within a short period of time there follows a second impulse causing also relay M_2 to close contact n_2 . Across this contact the winding of relay M_3 will be supplied with current whereby the reversing means are set in action, these open the rest contact n_4 and close the working contact n_3 . Now a second circuit is established across n_3 including a red

bulb *r* and the same battery *B*. As previously pointed out, the relay *M*₂ will be released with greater delay than relay *M*₁. Hence *M*₂ maintains its armature attracted up to the beginning of the second group of signals in accordance with Figure 2b. If the two signals which rapidly follow each other, arrive again, the attractive force will be increased, and the relay remains further attracted. The respectively connected lamp circuit will be periodically interrupted in the rhythm of the voltage peaks, i. e., in the rhythm of the signals, since the bulb current passes over working contact *n*₁ of relay *M*₁. The bulbs therefore respond in various rhythms in accordance as to whether signals according to Figure 2b or 3b arrive at the relay arrangement.

For the relay to respond with delay and to be released with delay, short circuit windings or similar damping means may be provided. The relay to respond rapidly but to be released with great delay, can be set in such manner that the armature can freely move at attraction and that at the return a coupling, for instance, may interfere connected with a delay movement such as, for instance, a propeller delay movement.

If the craft follows the desired or central guide line, i. e., the line of equal field intensities of two directive radiations, no indication occurs by the bulbs when using a blocking tube *N* or a biased valve. In order to enable the pilot to communicate instructions to the point of signal origin to control the proper functioning of a transmitter, as well as receiver, an indicating instrument *M* may be inserted in the control circuit or in the anode circuit of a controlled amplifier tube.

Furthermore, if the receiver is adjusted to the permanent dash line, no two species of impulses will occur, thus, there will exist at the terminals *K*, zero potential, so that in the relay circuit, at the terminals *K*, there will be no potential existing, so that neither relay *M*₁ nor relay *M*₂ is excited. In such a case, neither of the two lamps *r* or *g*, respectively, will respond.

The idea of the present invention is not limited to the examples of construction herein shown and described. As coupling means between the single stages there may also be used condensers and ohmic resistors to avoid distortions of the voltage curves. Furthermore, the putting into practice of the idea of the invention is not dependent upon the use of complementary signals.

Having thus described my invention, what I claim is:

1. A receiving system for the observation of two different signals, each one of said signals having a different arrangement of time lengths of impulses comprising an input and output circuit, an amplifier having a grid bias circuit coupled to said input circuit, an automatic volume control, a detector and a filter circuit coupled by a coupling device to the output of said amplifier, said filter circuit arranged to detect and smooth out the shortest time length of signal impulses received in said input circuit, said coupling device being connected in series with said detector, said filter and the grid bias circuit of said amplifier to provide grid bias potentials for controlling said amplifier to pass only the beginnings of the impulses of the signals.

2. A receiving system for the observation of two signals each one of said signals having a different arrangement of time length of signal impulses comprising an input and output circuit, a controlled amplifier having a grid bias circuit for a

plurality of electron discharge devices which are connected to said input circuit, a detector and a filter circuit coupled by a coupling device to the output of said amplifier, said detector and said filter circuit being arranged to detect and smooth out the shortest time length of signal impulses received in said input circuit, said coupling circuit being so connected to the grid bias circuit of said amplifier as to provide grid potentials for controlling the amplifier so as to pass only the beginnings of the impulses of said signals.

3. A receiving system according to claim 2 characterized in that the output circuit of said controlled amplifier is coupled to an electron discharge device which is so biased that the weaker of the two signals will cause no plate current to pass.

4. In a receiving system for receiving two signals comprising impulses of different character, an input circuit and an output circuit, an amplifier having means to maintain self-control at a constant volume level connected to said input circuit, a coupling device coupled to the output of said amplifier whereby a part of the current from said signal impulses is passed on to said means to control the grid bias of at least one tube in said amplifier, the time constant of control on said grid bias being governed by the constants of a filter device which is dimensioned so as to be actuated by the time length of impulse of the shortest length of signals.

5. In a receiving system for receiving two signals comprising impulses of different character, an input circuit and an output circuit, an amplifier having means to maintain self-control at a constant volume level connected to said input circuit, a coupling coil coupled to the output of said amplifier whereby a part of the current from said signal impulses is passed on to said means to control the grid bias of at least one tube in said amplifier, the time constant of control on said grid bias being governed by the constants of a filter device which is dimensioned so as to be actuated by the time length of impulse of the shortest length of signals, an electron discharge device coupled to the output of said amplifier which is biased so that the weaker of the two signals will cause no plate current to pass and allow the stronger signals to predominate, a plurality of time delay relays operated by said electron discharge device and having means for connecting to a luminous indicator.

6. In a receiving system for receiving two signals comprising signals of different character, an input circuit and an output circuit, an amplifier having means to maintain self-control at a constant volume level connected to said input circuit, a coupling device coupled to the output of said amplifier whereby a part of the current from said signal impulses is passed on to said means to control the grid bias of at least one tube in said amplifier, the time constant of control on said grid bias being governed by the constants of a filter device which is dimensioned so as to be actuated by the time length of impulse of the shortest length of signal, and a tube having a bias which allows only the stronger of the two signals to pass plate current coupled to the output of said amplifier.

7. In a receiving system for receiving two signals of different character of impulses comprising an input circuit and an output circuit, an amplifier having means to maintain self-control at a constant volume level connected to said input circuit, a coupling device coupled to the out-

put of said amplifier whereby a part of the current from said signal impulses is passed on to said means to control the grid bias of at least one tube in said amplifier, the time constant of control on said grid bias being governed by the constants of a filter device which is dimensioned so as to be actuated by the time length of impulse of the shortest length of signal, a tube having a highly negative bias which allows only the stronger of the two signals to pass plate current coupled to the output of said amplifier, and at least three time delay relays, at least two of which have windings in series with the output of said highly negative biased tube, the third relay having its winding connected with a source of energy and the contacts of the two windings of said relays.

8. A receiving system for receiving two signals of different character of impulses comprising an input circuit and an output circuit, an amplifier having means to maintain a constant volume level connected to said input circuit, a coupling device coupled to the output of said amplifier whereby a part of the current from said signal impulses is passed on to said means to control the grid bias of at least one tube in said amplifier, the time constant of control on said grid bias being governed by the constants of a filter device which is dimensioned so as to be actuated by the time length of impulses of the shortest length of signal,

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nal, a tube having a highly negative bias which allows only the stronger signals to pass plate current coupled to the output of said amplifier, and at least two time relays having their windings connected in series with the output of said last mentioned tube, a third relay and two light bulbs of different identifying means connected to the contacts of said first mentioned relays.

9. A receiving system for receiving and observation of two different signals, each one having a different character of impulses comprising an input and output circuit, an amplifier connected to said input circuit, a filter and a detector in series with the grid circuit of at least one tube of said amplifier, a coupling coil which is coupled to the output circuit of said amplifier whereby a portion of the current of said signal impulses is received in said coupling coil and is detected and filtered so as to pass only the beginnings of the signal impulses, an electron discharge device coupled to the output circuit of said amplifier, said electron discharge device biased so that the weaker of the two signals will cause no plate current to pass and allow the stronger signals to predominate, a plurality of individual relays operated by said signals, each individual relay having a time period of response and release which differs from each other relay.

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