

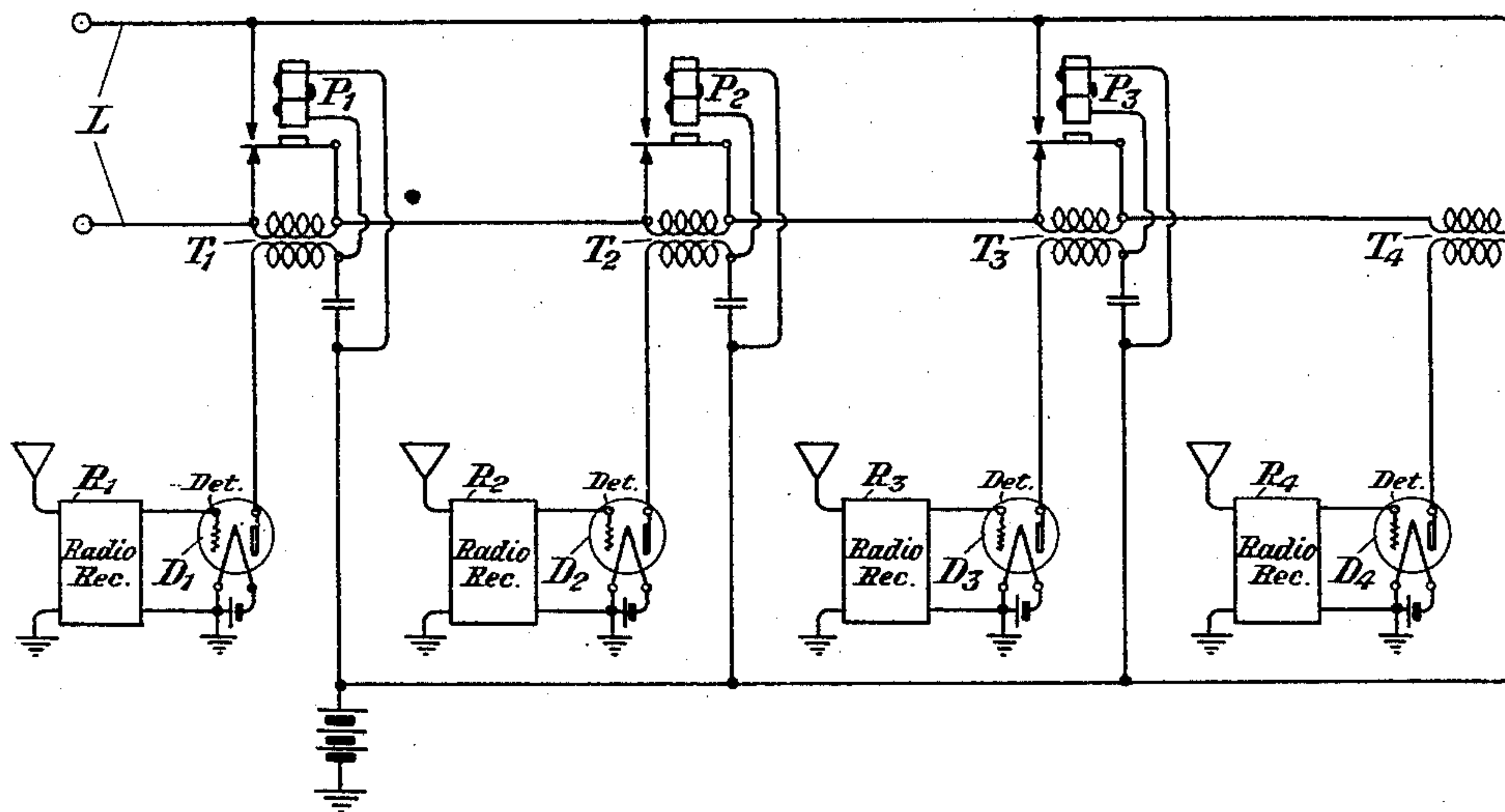
Feb. 18, 1930.

R. BOWN

1,747,220

AUTOMATIC SELECTION OF RECEIVING CHANNELS

Filed Dec. 11, 1928



INVENTOR

R. Bown

BY

John

ATTORNEY

UNITED STATES PATENT OFFICE

RALPH BOWN, OF MAPLEWOOD, NEW JERSEY, ASSIGNOR TO AMERICAN TELEPHONE
AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK

AUTOMATIC SELECTION OF RECEIVING CHANNELS

Application filed December 11, 1928. Serial No. 325,149.

This invention relates to methods and means for limiting the extent which any received signal may vary in intensity.

One source of signal variation is that due to changes in the strength of the signal as received from the signal medium. In the case of radio reception such variations are generally known as fading. Fading is particularly severe when receiving short wave lengths, and the method generally employed for maintaining a more or less constant demodulated signal has been to provide an automatic gain control or regulator. This method of regulation has certain limitations, however, and becomes inadequate, for example, when the signal drops below the limiting noise level. The present invention has as one of its objects the provision of a system which will be free from these limitations and may be used either independently or supplementary to automatic gain regulation for maintaining a constant output level at all times.

The invention is based on the fact that, if a number of receiving stations properly located and sufficiently far apart are used to pick up a transmitted signal, the signal does not fade similarly at each of the receiving stations. Observations made on various wave lengths have shown that the receiving antennæ need only be separated from each other by a distance of the order of a wave length or so in order to get this effect. The possibility of the signal fading out equally at all of the receiving stations at the same time is therefore reduced with increase in the number of receiving stations.

It has been heretofore proposed to use more than one receiver to pick up the radio signal and to choose for use the receiver giving the best results. In the past this was accomplished by cutting over manually from a receiver giving a signal of low volume to another which at the moment was giving a signal of larger volume, and again switching back to the first receiver or some other receiver as the signal again became low in volume. Obviously, such a method of operation was limited to cases where the changes in the signal occurred slowly enough to per-

mit the operator to select the best receiver or receiver output.

Where the signal intensity changes quite rapidly, as is often the case with short wave reception, a system capable at all times of rapidly cutting in the best of the available received signals is desirable. It is therefore proposed to use a number of receiving stations, properly located, and to continuously and automatically select the receiver or output of the receiver giving a useful signal, minimizing in this way the effect of rapid changes in the amplitude of the received current and reducing the possibility of the signal entirely fading out.

While it would be desirable to have the selecting apparatus so arranged as to always select the receiver having the largest signal output, excellent reception will always be obtained if the selected receiver has an output above a predetermined minimum. In accordance with the present invention, the selecting apparatus is arranged to select exclusively the first receiver whose output exceeds the predetermined minimum value, thereby permitting of the use of a very simple form of selecting circuit. The selecting arrangement may be operated either in response to the received carrier or in response to the detected signal component.

The invention will now be more fully understood from the following description when read in connection with the accompanying drawing, in which the figure shows an embodiment of the invention in which the selection is controlled by the received carrier.

Referring to the figure, four receivers are shown at R_1 , R_2 , R_3 and R_4 , although it will be understood that any number of receivers may be employed if desired. Each receiver is indicated symbolically and includes any necessary radio receiving apparatus commonly employed in the art. Each radio receiver also includes a detector indicated at D_1 , D_2 , D_3 and D_4 for the purpose of detecting from the received radio waves the speech or other signals in accordance with which the radio waves are modulated at the transmitting station. The received waves may be ap-

plied to the common receiving line L through transformers such as T_1 , T_2 , T_3 and T_4 .

In order to select the output of one receiver to the exclusion of the others, selecting relays P_1 , P_2 and P_3 are so connected to the output circuits of the detectors D_1 , D_2 and D_3 that the direct current component of the plate current may flow through the relay winding. As is well known, the amplitude of this direct current is determined by the received carrier and the received side bands corresponding to the signal, but as the carrier component is very large in energy as compared with the side band the direct current component is practically proportional to the received carrier. By making the relays P_1 , P_2 and P_3 marginal so that they will only operate in response to a current corresponding to a received carrier of predetermined amplitude, the circuit may be arranged to select exclusively a receiver whose received carrier signal exceeds such predetermined minimum. In order to accomplish this result each relay has its contacts so arranged that when it rests upon its back contact the secondary of the corresponding transformer, such as T_1 , will be short-circuited to prevent transmission to the line L from the corresponding receiver. When the armature of the relay rests upon its front contact, however, the short-circuit across the secondary of the transformer is opened and a direct short-circuit is placed across the line between the transformer and the transformers of all the receivers beyond it. As a result of this arrangement, if none of the receivers R_1 , R_2 and R_3 are receiving signals of sufficient volume to operate their switching relays, the transformers T_1 , T_2 and T_3 will be short-circuited, leaving the receiver R_4 effectively connected to the line L through the transformer T_4 . This receiver is, therefore, connected to the line to supply thereto such signal as it may be receiving even though none of the other receivers are receiving signals of sufficient amplitude to operate their selecting relays. If, however, one or more of the receivers R_1 , R_2 and R_3 should receive a carrier wave of sufficient amplitude to operate the corresponding relays, such as P_1 , the short-circuits will be removed from the secondaries of the corresponding transformers, such as T_1 , but only the transformer corresponding to the first relay operated from the left will be effectively connected to the line as the short-circuit across the line beyond this transformer effectively short-circuits all transformers beyond the first relay operated. For example, if relays P_2 and P_3 are operated and relay P_1 is not operated, the transformer T_1 will be short-circuited, but the short-circuits will be removed from the transformers T_2 and T_3 . The relay P_2 , however, by means of the short-circuit across the line at its front contact, effectively short-circuits the transformers T_3 and T_4 . Consequently, receiver

R_2 is exclusively connected to the line and transmission from receivers R_1 , R_3 and R_4 is prevented.

If, on the other hand, relays P_1 and P_3 are operated the short-circuits are removed from the transformers T_1 and T_3 , but a short-circuit is applied across the line over the front contact of the relay P_1 which effectively short-circuits transformers T_2 , T_3 and T_4 so that only receiver R_1 is so connected to the line that transmission can take place.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, normally inoperable successive connections along said receiving circuit for associating said receivers with said receiving circuit, and means whereby when any one of said connections is made operable all successive connections to one side thereof will be so disabled that connections cannot be established, said means leaving connections to the other side free to be made operable.
2. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, successive connections along said receiving circuit for associating said receivers with said receiving circuit, and means whereby when a plurality of said connections are made operable the first one in successive order will be given preference.
3. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, successive connections along said receiving circuit for associating said receivers with said receiving circuit, and means whereby when a plurality of said connections are made operable the first in successive order will be given preference and all connections beyond will be disabled.
4. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, normally disabled

connections along said receiving circuit for associating said receivers with said receiving circuit, and means whereby when one of said connections is made operable all successive connections to one side thereof will be independently disabled.

5 5. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, normally disabled connections along said receiving circuit for associating said receivers with said receiving circuit, and means whereby when a plurality of said connections are made operable the first one in successive order will be given preference.

10 6. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, normally disabled connections along said receiving circuit for associating said receivers with said receiving circuit, and means whereby when a plurality of said connections are made operable the first one in successive order will be given preference and all connections beyond will be independently disabled.

20 7. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, a transformer for each receiver through which transmission may take place from the receiver to the receiving circuit, said transformers being associated with said receiving circuit in successive order from the receiving terminals thereof and being normally disabled, and means whereby when one of said transformers is made operable all transformers beyond such transformer with respect to the receiving terminals will be independently disabled.

40 8. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, a transformer for each receiver through which transmission may take place from the receiver to the receiving circuit, said transformers being associated with said receiving circuit in successive order from the receiving terminals thereof and being normally disabled, and means whereby when a plurality of said transformers are made operable the first one in successive order from

the receiving terminals will be given preference.

9. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, a transformer for each receiver through which transmission may take place from the receiver to the receiving circuit, said transformers being associated with said receiving circuit in successive order from the receiving terminals thereof and being normally disabled, and means whereby when a plurality of said transformers are made operable the first one in successive order from the receiving terminals will be given preference and all transformers beyond will be independently disabled.

10. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, successive connections along said receiving circuit for associating said receivers with said receiving circuit, selecting relays controlled by each receiver, means controlled by said selecting relays for normally disabling said connections, and means whereby when one of said relays is operated the connection controlled thereby will be rendered operable and all successive connections to one side thereof will be independently disabled.

11. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, successive connections along said receiving circuit for associating said receivers with said receiving circuit, selecting relays controlled by each receiver, means controlled by said selecting relays for normally disabling said connections, and means whereby when several of said relays are operated the operated relay which is first in successive order will render its controlled connection operable and will independently disable all connections beyond.

12. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, successive connections along said receiving circuit for associating said receivers with said receiving circuit, selecting relays controlled by each receiver and having predetermined margins so

that each relay will operate when its corresponding receiver receives signaling energy at a level sufficient to overcome the margin, means controlled by said selecting relays for normally disabling said connections, and means whereby when any relay is operated the connection controlled thereby will be rendered operable and the successive connections to one side thereof will be independently disabled.

13. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, successive connections along said receiving circuit for associating said receivers with said receiving circuit, selecting relays controlled by each receiver and having predetermined margins so that each relay will operate when its corresponding receiver receives signaling energy at a level sufficient to overcome the margin, means controlled by said selecting relays for normally disabling said connections, and means whereby when a plurality of said relays are operated to render their controlled connections operable the operated relay which is first in successive order with respect to the receiving circuit independently disables the connections arranged in order beyond it.

14. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same carrier frequency signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, and means controlled by the received carrier component of a given receiver to connect that receiver to the receiving circuit exclusively of the others.

15. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same carrier frequency signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, and means controlled by the received carrier components of the several receivers to connect to the receiving circuit a receiver whose received carrier component exceeds a predetermined minimum.

In testimony whereof, I have signed my name to this specification this 7th day of December, 1928.

RALPH BOWN.

DISCLAIMER

1,747,220.—*Ralph Bown*, Maplewood, N. J. AUTOMATIC SELECTION OF RECEIVING CHANNELS. Patent dated February 18, 1930. Disclaimer filed March 6, 1934, by the assignee, *American Telephone and Telegraph Company*.

Hereby enters this disclaimer to claim 14 of said Letters Patent, to wit:

"14. In a signaling system subject to variable transmission conditions, a plurality of receivers each receiving the same carrier frequency signal and so related to each other that the received signals vary differently at the several receivers with variations in transmission conditions, a receiving circuit, and means controlled by the received carrier component of a given receiver to connect that receiver to the receiving circuit exclusively of the others."

[*Official Gazette March 27, 1934.*]