

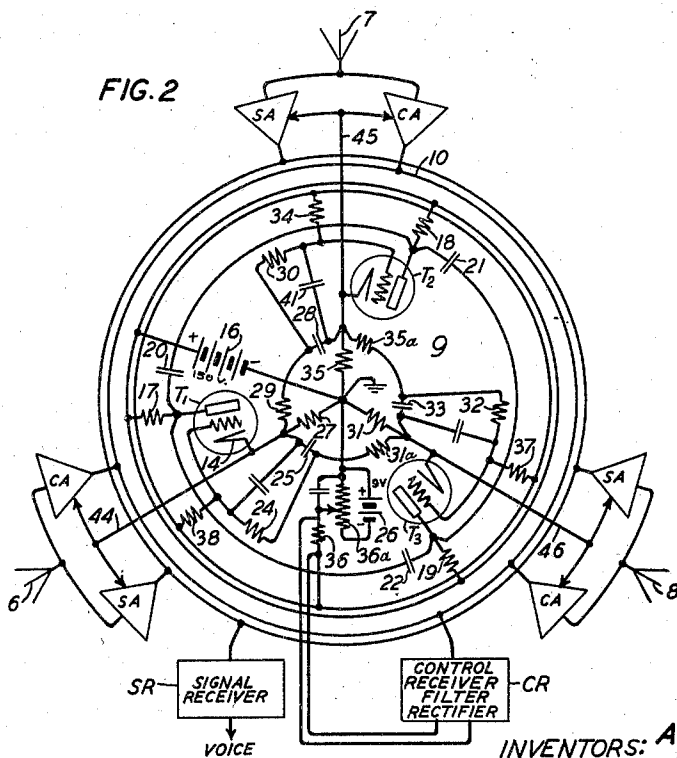
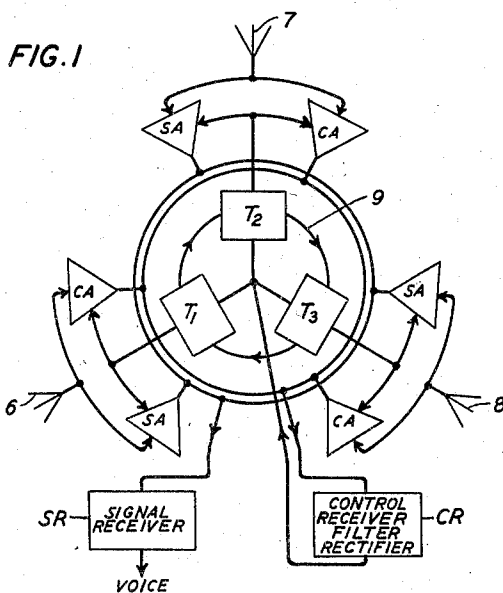
Nov. 15, 1938.

A. P. KING ET AL.
ANTENNA SELECTOR SYSTEM

2,136,621

Filed June 20, 1936

2 Sheets-Sheet 1



INVENTORS: A.P. KING
R.S. OHL
BY
E.V. Briggs
ATTORNEY

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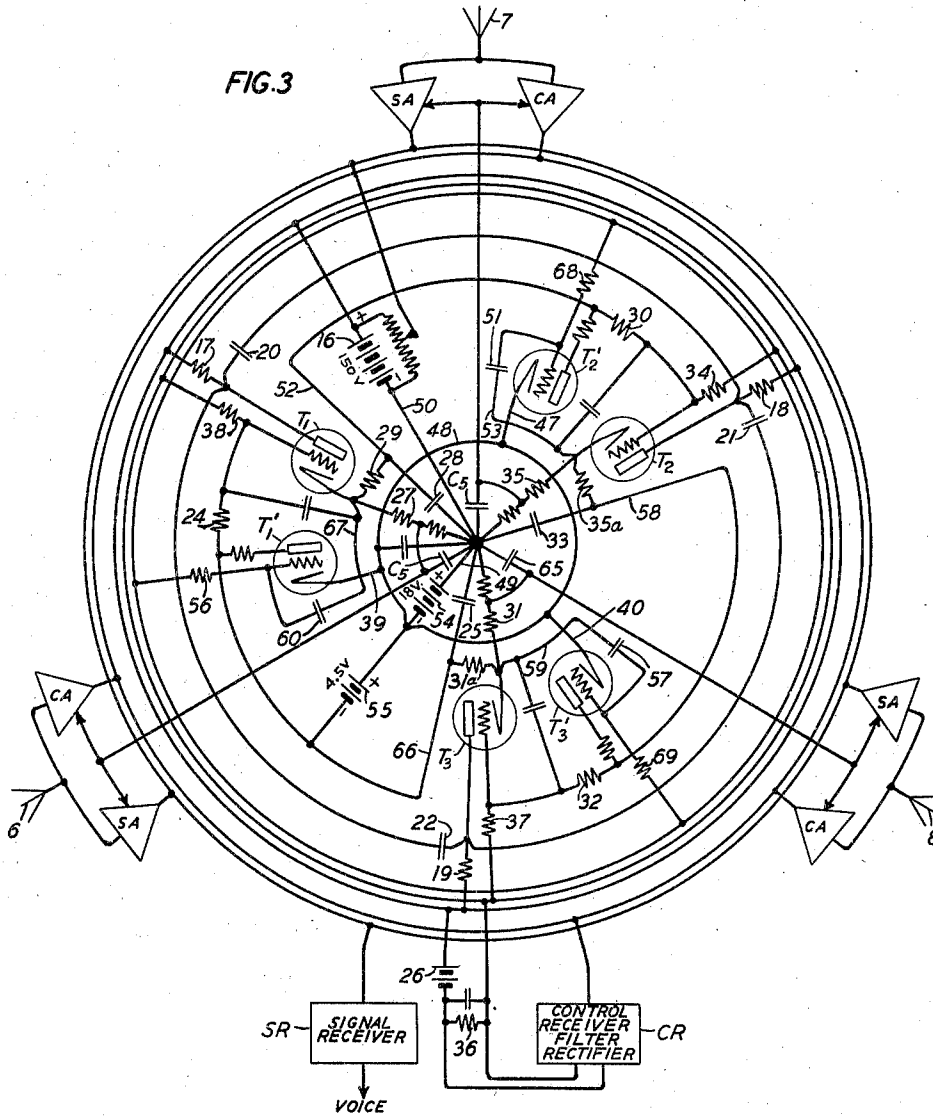
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2 Sheets-Sheet 2



INVENTORS: **A.P.KING**
R.S.OHL
BY **E.V. Griggs**
ATTORNEY

UNITED STATES PATENT OFFICE

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ANTENNA SELECTOR SYSTEM

Archie P. King, Red Bank, and Russell S. Ohl,
Little Silver, N. J., assignors to Bell Telephone
Laboratories, Incorporated, New York, N. Y.,
a corporation of New York

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6 Claims. (Cl. 250—20)

This invention relates to radio receiving apparatus, and more particularly to a means and method of antenna selection for minimizing fading in the reception of radio signals.

It is an object of this invention to select from a plurality of antennas that antenna supplying the strongest signal.

In a preferred embodiment, the invention comprises a plurality of geographically separated antennas, each of which is connected to a signal-amplifier and a control-amplifier. Suitable biases render the amplifiers normally inoperative to incoming signals via their associated antennas. An oscillating circuit comprising a plurality of electron discharge devices is also connected to the amplifiers and arranged to ionize the electron devices so as to intermittently develop potentials which are applied to the amplifiers. These potentials serve to overcome the biases to render the amplifiers operative seriatim, and, at the same time, to effect a rotation of ionization among the electron devices.

In operation, the oscillating circuit rotates ionization among the electron discharge devices until an antenna collecting signals of a predetermined level is connected to its associated amplifiers when the latter are in the operative state. Thereupon, the operative control-amplifier impresses a potential on the oscillating circuit to counteract the developed potential insofar as the rotation of ionization is concerned. As a result the progression of ionization is arrested at this point. At the same time, the operative signal-amplifier impresses a signal voltage on a receiver adapted to provide a suitable reception of the transmitted signal. So long as this antenna continues to collect signals of the required strength, action in the oscillating circuit will remain suspended. When, however, the collected signals fall below the predetermined level, the antenna will be released and the oscillating circuit caused to resume the rotation of ionization. Such rotation continues until another antenna, or the same antenna, collecting signals of the predetermined level is reached whereupon the above action will be repeated.

The invention will be more fully understood from the following description taken together with the accompanying drawings, in which:

Fig. 1 is a block diagram illustrating the preferred embodiment of the invention;

Fig. 2 is a diagrammatic circuit showing in detail the embodiment of Fig. 1; and

Fig. 3 is a diagrammatic circuit delineating in detail a modification of Fig. 2.

In the following description, the same reference numerals will be employed to designate identical elements appearing in the several figures.

Operation of Fig. 1

In Fig. 1, an oscillating circuit 9 comprising a plurality of gas-filled electron discharge devices T_1 , T_2 , and T_3 of the three-element type is so arranged that ionization of the electron devices progresses seriatim in the direction indicated by the arrows. The arrangement also provides for a predetermined period of ionization for the individual electron devices. Each of the latter is connected to a signal-amplifier SA and a control-amplifier CA, both of which have their inputs connected directly to an antenna. The outputs of the control-amplifiers CA are impressed on the oscillating circuit through a common control-receiver CR which includes a filter and a rectifier. The outputs of the signal-amplifiers SA are connected to a common signal-receiver SR. The control and signal amplifiers may be of any suitable type and are arranged so that grid biases normally render them inoperative to signals incoming via their associated antennas. The oscillating circuit is so designed that during the deionized periods of electron devices T_1 , T_2 or T_3 the associated amplifiers are inoperative while during the ionized periods a developed potential overcomes the biasing potential to render the associated amplifiers operative.

For the purpose of description, let it be assumed that while T_1 is ionized, a signal of a predetermined level is being collected by antenna 6. It will be understood, of course, that the amplifiers connected to this antenna are in the operative state. This signal will be amplified by the associated control-amplifier CA and impressed through control-receiver CR on the oscillating circuit as a potential of such magnitude that it will arrest the progression of ionization at T_1 . At the same time, signal-amplifier SA associated with antenna 6 will impress a signal voltage on the signal-receiver SR. So long as antenna 6 collects signals of at least the predetermined magnitude, the amplifiers connected thereto will remain in an operative condition to impress signal voltages on the receivers CR and SR.

At the instant, however, when the signals collected on antenna 6 fall below the predetermined level, T_1 deionizes. As a result the biasing potentials are reapplied to the associated amplifiers to render them inoperative to further signal reception. The progression of ionization of the

devices T₂, T₃ and T₁ is resumed until another antenna collects the required magnitude of signal whereupon ionization is again arrested in the manner as aforescribed.

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Operation of Fig. 2

Fig. 2 illustrates in detail the circuit connections for the block diagram of Fig. 1. The cathode circuit of each electron device T₁, T₂, or T₃ comprises a cathode 14 and a suitable "A" battery, not shown. This arrangement for energizing the cathode is well known in the art. The anodes of T₁ and T₂ are directly connected by a condenser 20; those of T₂ and T₃ by a condenser 21; and those of T₃ and T₁ by a condenser 22. Also, the anodes of T₁, T₂ and T₃ are connected through resistances 17, 18 and 19, respectively, to the positive terminal of "B" battery 16 which impresses a positive potential of 150 volts on each of the anodes with respect to their associated cathodes.

The negative terminal of "B" battery 16 is connected to one side of a potentiometer 36a across which is connected a "C" battery 26. The adjustable contact of the potentiometer is connected through resistance 36, and resistances 38, 34 and 37 to the grids of T₁, T₂ and T₃, respectively. Normally, "C" battery 26 impresses a negative potential, or bias, on the grids of T₁, T₂ and T₃.

Resistance 27 connected in series with the cathode of T₁ is also contained in a series circuit embodying resistance 35, condenser 28, and resistance 29. Condenser 28 acts on the grid of T₂ through resistance 30 in a manner that will be subsequently explained. Resistance 35 connected in series with the cathode of T₂ is also included in a series circuit containing resistance 31, condenser 33, and resistance 35a. Condenser 33 acts on the grid of T₃ through resistance 32 in a manner that will also be hereinafter described. Resistance 31 connected in series with the cathode of T₃ is also embodied in a series circuit including resistance 27, condenser 25, and resistance 31a. Condenser 25 acts on the grid of T₁ through resistance 24, in a manner that will likewise be later explained.

When T₁, T₂ or T₃ is in the deionized state, a bias, not shown, is normally impressed on the grids of the amplifiers SA and CA, a pair of which is connected to each of the antennas 6, 7 and 8. The circuit arrangements for supplying the biases are well known and are, of course, included in the block representations SA and CA. As a consequence of the biases, the amplifiers are normally rendered inoperative to signals incoming over the antenna to which they are connected.

The electron discharge devices T₁, T₂ and T₃ are of a well-known construction and comprise gas-filled envelopes, each containing an electron emitting cathode, a grid, and an anode. Their structure is such that when, in a suitable circuit, a positive potential is applied to the anode, the grid, if impressed with a sufficiently high negative potential, interposes a high-starting resistance to its arc discharge. Hence, there will be no flow of space current. When, however, the potential of the grid is caused to become less negative, the arc discharge of the device may be started thereby producing a flow of space current therein between the anode and cathode.

A characteristic of this type of electron device is such that while the grid potential may be utilized to initiate the arc discharge of the device,

thereafter it is ineffective to influence the arc discharge. The latter, once it is started, can be stopped only by removing the positive anode voltage.

In operation, the oscillating circuit 9 is so designed that the electron devices ionize in order of T₁, T₂, T₃, T₁, T₂, . . . For the purpose of facilitating the description, let it be assumed, as in connection with Fig. 1, that T₁ is ionized and as a result space current is flowing between its anode and cathode. This gives rise to a potential across the resistance 27 contained in a series circuit comprising the cathode of T₁, resistance 27, battery 16, anode resistance 17, and the anode of T₁. This potential develops an exponentially increasing voltage to charge condenser 28 which is embodied in a series circuit consisting of resistances 27 and 35, condenser 28, and resistance 29.

When the charge on condenser 28 attains a certain value, the charge acting through resistance 30 develops a positive potential which is applied to the grid of T₂. This counteracts the steady negative potential impressed on the grid T₂ by "C" battery 26, and renders the grid of T₂ less negative until the value of the grid-trip potential of T₂ is reached whereupon the arc discharge of T₂ is instituted to produce a flow of space current between its anode and cathode.

Once the arc discharge of T₁ is started, it may be stopped only by removing the positive anode voltage therefrom. This is accomplished by means of the anode resistances 17 and 18, and condenser 29, all of which are utilized as follows: When T₁ was in the first instance, in the deionized state, its anode voltage had an initial level of 150 volts since there was no flow of space current. In ionizing, the anode voltage of T₁ was decreased by 110 volts. In other words, the anode voltage of T₁ was changed from 150 volts to 40 volts with respect to negative ground. The 40 volt anode voltage comprises 15 volts, the ionization voltage of the electron device, and 25 volts, which is developed across the cathode resistance 27.

Similarly, in the first instance, the anode voltage of T₂ was also 150 volts due to an absence of space current therein. In ionizing, the anode voltage of T₂ was also lowered to 40 volts with respect to ground. The latter voltage consists of 15 volts, the ionization potential of the electron device, and 25 volts which is developed across the cathode resistance 35.

Therefore, when both T₁ and T₂ were in the deionized state, each side of condenser 20 was impressed with a potential of 150 volts by "B" battery 16 acting through resistances 17 and 18. Since T₁ was the first to ionize, the potential on both sides of condenser 20 was lowered by 110 volts, that is, to 40 volts—for an instant. Accordingly, the voltages applied to the anodes of T₁ and T₂ were also lowered to 40 volts for the same instant. Since T₁ continues to ionize, the side of condenser 20 connected thereto will remain at a potential of 40 volts while the potential on the side of condenser 20 connected to T₂ will be returned to a level of 150 volts since T₂ is still deionized.

As T₂ ionizes, the potential applied to both sides of condenser 20 is again lowered by 110 volts—for an instant. Accordingly, the potentials applied to the anodes of T₁ and T₂ are also lowered by 110 volts for the same instant. Since the voltage on the side of condenser 20 connected to T₁ was 40

volts, it is now decreased for an instant by 110 volts, that is, by the algebraic sum of (+)40 and (-)110, to an instantaneous (-)70 volts. For the same instant, the voltage impressed on the anode of T₁ by this side of condenser 20 is likewise (-)70 volts. The side of condenser 20 connected to T₂ was also lowered by 110 volts, and remains at a steady level of 40 volts since T₂ is now ionized. Through the action of resistance 17 and condenser 20, the anode voltage of T₁ was lowered to an instantaneous value of (-)70 volts.

This change of the anode voltage of T₁ from a (+)40 volts to an instantaneous (-)70 volts extinguishes the arc discharge of T₁ to terminate the flow of space current therein. As a consequence, 150 volts is again impressed by battery 16 on the anode of T₁, and of course the same voltage is applied to the side of condenser 20 connected thereto. At the same time a potential of 40 volts is impressed on the anode of ionized T₂ and, also, on the side of condenser 20 connected thereto. For the above instant, condenser 20 may be considered a very low impedance or a direct metallic connection between the anodes of T₁ and T₂, in effecting the negative voltage on the anode of T₁.

The functions of the anode resistances 17 and 18 are twofold; first, to limit the space current flowing in T₁ and T₂ when ionized, and, second, to act as large impedances in effecting the (-)70 volts on one side of the condenser 20. Resistance 34 acts to maintain a sufficiently large level of grid bias on T₂ to preclude an ionization thereof in any manner other than by the action of condenser 28. The period of ionization of T₁ is a function of the time constant comprising resistance 27 and condenser 28.

In a similar manner, the ionization of T₂ develops a voltage across the cathode resistance 35 to charge condenser 33. The latter acts through resistance 32 to make the grid bias of T₃ less negative until the grid-trip voltage of T₃ is reached whereupon its arc discharge is started. As T₃ ionizes, the side of condenser 21 connected to T₂ has its potential lowered to an instantaneous (-)70 volts which is applied to the anode of T₂. This extinguishes the arc discharge of T₂. Anode resistances 18 and 19 limit the space current during the ionizations of T₂ and T₃ and, also, act as large impedances in effecting the (-)70 volts on the condenser 21. Resistance 37 acts to provide a level of grid bias on T₃ that prevents an ionization of the latter in any fashion other than by the combined action of condenser 33 and resistance 35, both of whose values determine the period of ionization of T₃.

Likewise, the ionization of T₃ develops a voltage across the cathode resistance 31 to charge condenser 25 which acts through resistance 24 to render the grid bias of T₁ less negative. This continues until the grid-trip voltage of T₁ is attained whereupon the arc discharge thereof is commenced. As T₁ ionizes, the voltage of the side of condenser 21 connected to the anode of T₃ is decreased to an instantaneous (-)70 volts which is, of course, impressed on the anode of T₂. This potential extinguishes the arc discharge of T₃. Anode resistances 19 and 17 limit the space-current flow in T₃ and T₁, and, in addition, serve as large impedances to produce the (-)70 volts on the condenser 21. Resistance 38 provides a level of grid bias for T₁ that prevents its ionization in any manner other than by the dual action of condenser 25 and resistance 31, both of which may be varied in value to fix the period of ionization of T₁.

A steady biasing potential is normally impressed on the grids of the amplifiers CA and SA associated with the antennas 6, 7 and 8. As previously pointed out, these biases are well known and are supplied from the electrical connections necessary for the operation of the amplifiers. The biases serve to render the amplifiers inoperative to the reception of signals incoming on the antennas to which they are connected. Lead 44 connects the grids of the amplifiers associated with antenna 6 to the cathode resistance 27; lead 45 connects the grids of the amplifiers associated with antenna 7 to the cathode resistance 35; and lead 46 connects the grids of the amplifiers associated with antenna 8 to the cathode resistance 31. As T₁, T₂ or T₃ ionizes in the order and manner aforescribed, the potentials developed across the cathode resistances 27, 35 and 31 overcome the biases to render each pair of amplifiers operative in the same order. Since only one electron device is ionized at a time, then only the pair of amplifiers and the antenna associated therewith are operative to the collection of signals during any given instant. Such operation will now be more adequately described.

Since, for this description, T₁ was assumed to be ionized, it will be understood that the potential developed across the cathode resistance 27 served to overcome the biases on the amplifiers connected to antenna 6. Therefore, the latter and its associated amplifiers are rendered operative to signal reception. Let it be further assumed that signals of at least a predetermined strength are being collected on this antenna. These signals will be amplified by control-amplifier CA and impressed by control-receiver CR as direct current voltages across the resistance 36. These voltages augment the biases supplied by battery 25 to the grids of T₁, T₂ and T₃, and, hence render ineffective the potential developed across resistance 27, which as hereinbefore explained, was also utilized to effect the arc discharge of T₂. As a consequence, ionization is arrested at T₁ while T₂ and T₃ continue in the deionized state. At the same time, signal-amplifier SA, which is also connected to antenna 6, impresses signal voltages on the signal-receiver SR. By means of the latter, a visual or audible reception of the transmitted signal may be effected, as desired.

It will be understood that the filter included in the control-receiver CR passes the carrier but attenuates the side-bands. This is necessary in order to avoid a false operation of the oscillating circuit during high modulation peaks. A suitable rectifier is also included in the control-receiver CR so as to provide the direct current voltages which are applied to the resistance 36.

So long as antenna 6 continues to collect signals of the required strength, it will be held connected to the common receivers CR and SR. When the collected signals fall below the predetermined strength, the control voltage impressed across the resistance 36 will be insufficient to counteract the potential developed across the resistance 27. As hereinbefore described, the latter potential was employed to start the arc discharge of T₂, therefore the progression of ionization will commence from this point. As T₂ ionizes, T₁ will of course deionize. The rotation of ionization will continue until another antenna, or antenna 6, supplies a control voltage of sufficient strength to arrest ionization in the manner aforescribed relative to antenna 6.

It is to be understood that the potential developed across the cathode resistance 27 continues

to build up to charge condenser 28 in the presence of the control voltage applied across resistance 36. This is necessary so that the arc discharge of T₂ can be instantaneously effected when the signals collected on antenna 6 fall below the predetermined amount. Such is also the case with respect to the cathode resistances 35 and 31 and their associated condensers when the signals collected on antennas 7 and 8, respectively, fall below the required strength.

By means of the oscillating circuit, therefore, that antenna collecting signals of at least a predetermined strength is automatically selected from a group of geographically spaced antennas in order to minimize fading in the reception of radio signals.

Operation of Fig. 3

The operation of Fig. 3 is fundamentally the same as the circuit aforescribed in connection with Figs. 1 and 2, except that the electron discharge devices T₁, T₂, and T₃ have operatively connected thereto identical electron discharge devices T'₁, T'₂, and T'₃. In addition, condenser 25 is connected to the anode of T'₁ as well as to the grid of T₁; condenser 28 is connected to the anode of T'₂ and the grid of T₂; and condenser 33 is connected to the anode of T'₃ and the grid of T₃. Also, the voltage developed across resistance 27 serves to charge condenser 28 and condenser 60 which is directly connected to the grid of T'₁; the voltage developed across resistance 35 acts to charge condenser 33 and condenser 51 which is connected to the grid of T'₂; and the voltage developed across the resistance 31 is employed to charge condenser 25 and condenser 57 which is connected to the grid of T'₃.

Battery 54 applies a positive potential to the anodes of T'₁, T'₂, and T'₃; and battery 55 impresses a biasing potential on the grids of the same electron discharge devices. The function of T'₁, T'₂, and T'₃ will now be explained.

As in the cases of the previous figures, let it be also assumed that T₁ was initially ionized, then T₂ was ionized, and thereafter T₁ was deionized. As T₂ ionized, the voltage developed across resistance 35 charges condensers 33 and 51. When the latter attains a predetermined charge it impresses a momentary surge of positive potential on the grid of T'₂ thereby rendering the grid less negative. As a result, the arc discharge of T'₂ is started to institute a flow of space current therethrough. Considering that condenser 28 is connected to the anode of T'₂, the former may also be deemed to be connected between the anode and cathode of T'₂. This circuit comprises condenser 28, lead 52, anode and cathode of T'₂, leads 47, 48 and 49, battery 54, lead 50 and back to condenser 28. As soon as condenser 28 has served to start the arc discharge of T'₂, the condenser 28 is completely and quickly discharged through T'₂. As a result, the anode potential of T'₂ is decreased and, hence, its arc discharge is instantly terminated. Accordingly, the exclusive function of T'₂ is to discharge instantaneously condenser 28 after T₂ commences to ionize.

Similarly, as T₃ ionizes, the voltage developed across the resistance 31 charges both condenser 25 and condenser 57. When the latter reaches a predetermined value, it impresses a momentary surge of positive potential on the grid of T'₃ thereby rendering the grid bias less negative. As a consequence, the arc discharge of T'₃ is begun. This causes a flow space current through T'₃. Since condenser 33 is connected to the anode

of T'₃, the former may also be considered as connected between the anode and cathode of T'₃. This circuit consists of condenser 33, lead 58, anode and cathode of T'₃, lead 49, lead 48, lead 49, battery 54, lead 50, and back to condenser 33. As soon as condenser 33 has effected the arc discharge of T'₃, the condenser 33 is entirely and instantaneously discharged through T'₃. Accordingly, the anode potential of T'₃ is decreased to end the arc discharge of T'₃. Therefore, the exclusive function of T'₃ is to dissipate instantaneously the charge remaining on condenser 33 after the latter has acted to ionize T₃.

Likewise, as T₁ ionizes, the voltage produced across resistance 27 charges both condenser 28 and condenser 60. As the latter approaches a certain level of charge, it impresses a momentary surge of positive potential on the grid T'₁ thereby rendering the grid less negative. As a result, the arc discharge of T'₁ is commenced to produce a flow of space current therethrough. Since condenser 25 is connected to the anode of T'₁ the former may be also considered as between the anode and cathode of T'₁. This circuit comprises condenser 25, lead 65, anode and cathode of T'₁, lead 39, lead 48, lead 49, battery 54, lead 50, and back to condenser 25. As soon as condenser 25 has caused the arc discharge of T'₁, the condenser 25 is completely and quickly discharged through T'₁. Consequently, the anode potential of T'₁ decreases to stop the arc discharge of T'₁. Accordingly, the exclusive function of T'₁ is to dissipate completely and quickly the charge remaining on condenser 25 after the latter has produced the ionization of T₁.

The advantages of using T'₁, T'₂, and T'₃ in conjunction with the tubes T₁, T₂ and T₃ include the following: (1) the electron discharge devices will not require careful selection since normal tube variations will not tend to change the operation of the oscillating circuit; (2) the circuit is more stable since the frequency of operation is more constant; (3) there is increased frequency range; (4) in view of the rapidity with which the condensers 25, 28 and 33 may be discharged, the condensers 26, 21 and 22 may have smaller capacities than those utilized in Fig. 2; and (5) a decreased voltage may be supplied by the control amplifiers CA for controlling the progression of ionization among T₁, T₂, and T₃.

While the invention is disclosed with particular reference to a system of antenna selection, it will be understood that it is not necessarily limited thereto and is readily capable of other applications. Moreover, it will be understood that a use of three electron discharge devices in the oscillating circuit is merely optional since a different number may be used depending on the application of the circuit.

One such application of the invention may consist in providing current pulses for controlling the time of a sequence of electrical operations, or in providing a definite delay in the operation of an electrical circuit. For these purposes, the time constants for T₁, T₂ and T₃, as hereinbefore mentioned, may be varied so that the periods of ionization may be adjusted to effect, for example, a delay of five seconds followed by a pulse of long or short duration. One of the periods of ionization may be adjusted to provide a pulse of $\frac{1}{10,000}$ to $\frac{1}{10,000,000}$ of a second.

Another application of the invention may consist in studying two or more phenomena on a single cathode-ray tube. For this purpose, the oscillating circuit may comprise two electron de-

5 vices arranged to control two amplifiers for alternately energizing a cathode-ray oscillograph. The circuits to be compared or studied would be connected to the amplifiers for short intervals of the order of $\frac{1}{100}$ — $\frac{1}{1000}$ of a second. The persistence of vision would make the two phenomena appear simultaneously for comparison. Such an arrangement may be used for studying or comparing phase amplitude, frequency, etc., between two or more circuits. The necessary control voltage may be obtained from the plate or cathode circuits of each electron device.

10 The invention may also be applied to a telephone selector system. In this event, ten or more electron devices would be required. The dialing of a telephone would supply pulses so that each pulse would cause the ionization to progress from one electron device to the succeeding one. In such a case, the time constants of the electron devices would be somewhat shorter than the dialing interval but longer than the pulse. The lock-in and circuit transfer may be accomplished by relays in the plate circuits, or by electronic devices.

25 It is obvious that the invention herein disclosed is capable of various other modifications and applications and is to be limited only by the scope of the appended claims.

What is claimed is:

30 1. A radio receiving system comprising in combination, a plurality of geographically spaced antennas, a pair of amplifiers connected to each antenna for receiving signals therefrom, switching means for automatically rendering each pair of amplifiers operative and inoperative seriatim, means connected to one amplifier for impressing a potential on the switching means to hold operative both amplifiers in response to an antenna supplying signals of a predetermined strength, and a receiver connected to the other amplifier to utilize the signals incoming on the antenna serving to hold the pair of amplifiers operative.

2. A radio receiving system comprising in combination, a plurality of geographically spaced antennas, a signal-amplifier and a control-amplifier connected to each antenna for receiving signals therefrom, circuit connections for the amplifiers embodying grid biases that normally render the amplifiers inoperative, self-actuating means connected to the amplifiers and arranged to develop intermittently potentials which serve successively to overcome the biases to render the amplifiers associated with each antenna operative, means responsive to signals of a predetermined strength collected on that antenna connected to an operative control-amplifier for impressing on the self-actuated means a potential which serves to counteract the developed potentials thereby suspending action in the self-actuated means, and a receiver connected to the operative signal-amplifier at which the self-actuated means was arrested for utilizing the signals received on the antenna connected thereto.

3. A system according to claim 2 in which the self-actuating means comprises a plurality of gas-filled electron discharge devices and circuit

connections therefor so arranged as to effect ionization of the electron devices in a predetermined order, each ionized electron device developing a potential which serves to overcome the biases on the amplifiers associated therewith so as to operatively connect the amplifiers to their associated antenna in the order of the ionization of the electron devices.

4. A system according to claim 2 in which the self-actuated means comprises a plurality of electron discharge devices each of which includes a cathode, an anode, and a grid; a resistance connected to each cathode, a capacity connected to the grid of each electron device and in series with the cathode resistance of a preceding electron device, a capacity connecting the anodes of adjacent electron devices, a "B" battery for initially impressing a positive potential on both sides of the anode capacities, a "C" battery for impressing a negative bias on the grid of each electron device, and circuit connections embodying the electron devices and associated elements; the circuit connections being so arranged that when the first electron device is ionized a potential is developed across its cathode resistance to overcome the biases on the amplifiers connected thereto and also to charge the grid capacity connected in series therewith until the grid potential of the succeeding electron device is rendered sufficiently less negative to permit the ionization of that electron device, the second ionized electron device overcoming the biases on the amplifiers connected thereto to render them operative and, at the same time, changing from a positive to a negative potential the side of the anode capacity connected to the anode of the preceding ionized electron device thereby deionizing that electron device to render effective the biases on the amplifiers connected thereto, the cathode resistance and capacities associated with each electron device acting in a similar manner to ionize the succeeding electron device and to deionize the preceding ionized one.

5. A system according to claim 2 in which an auxiliary means is operatively connected to the self-actuated means to speed up the action of rendering the pairs of amplifiers operative.

6. A radio receiving system comprising in combination, a group of geographically spaced antennas, a pair of amplifiers associated with each antenna and rendered normally inoperative by grid biases, self-actuating means including condensers intermittently charged to overcome the biases to render each pair of amplifiers operative seriatim, means responsive to a signal of predetermined strength received on an antenna connected to an operative pair of amplifiers for producing potentials opposing the charges on the condensers, thereby arresting action in the self-actuating means, and auxiliary means connected to the self-actuating means for discharging the condensers to accelerate the action of rendering the pairs of amplifiers operative.

ARCHIE P. KING.
RUSSELL S. OHL.