Aug. 17, 1948. L. B. BRITTAIN 2,447,156

RADIO CONTROL SYSTEM

Filed Feb. 23, 1942

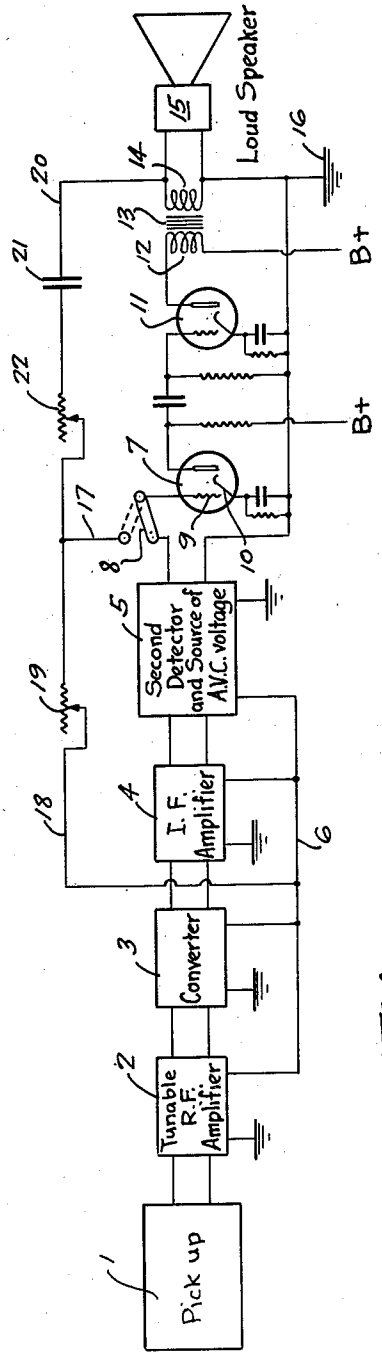


Fig. 1

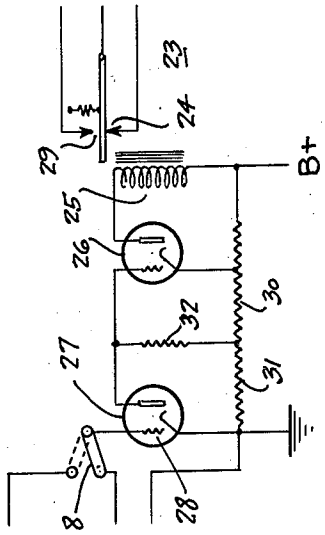


Fig. 2

INVENTOR
Louis B. Brittain
BY John Flans
ATTORNEY

Patented Aug. 17, 1948 2,447,156

UNITED STATES PATENT OFFICE

2,447,156

RADIO CONTROL SYSTEM

Louis B. Brittain, Los Angeles, Calif.

Application February 23, 1942, Serial No. 431,909

8 Claims. (Cl. 250—20)

1

This invention relates to a radio receiving device, and particularly to a radio set arranged to respond to certain conditions of reception.

Radio sets for receiving broadcast programs are now very extensively used, and are uniformly arranged to be accurately tuned to any of a number of carrier wave frequencies corresponding to the broadcasting stations.

By appropriate direction finding apparatus, those broadcasting stations, if on the air, can serve quite effectively to guide enemy war planes to their objectives. Accordingly in time of war, broadcasting stations in a certain locality are ordered off the air just as soon as unidentified or enemy planes are detected in that locality, indicating an imminent air raid. The cessation of broadcasting therefore is, to the public, a forewarning of an air raid.

This forewarning is of particular importance to place the members of civilian defense on the alert; but when the broadcasting stations go off the air, often those most concerned with this do not have their radio sets in operation.

It is one of the objects of this invention to make it possible to operate a signal or a control device, such as a relay, upon cessation of broadcasting; and particularly to accomplish this result while the radio set is silent.

It is another object of this invention to make it possible to use a standard set, with the addition merely of a few inexpensive parts, to effect the desired results.

In order to accomplish these objects, the invention contemplates the use of the carrier wave energy received from a specific tuned-in station, to render the set ineffective; and as soon as the carrier wave ceases, the set can operate to produce a signal or control effect, such as for example through the usual loud speaker or by aid of a relay device.

More specifically, almost all radio receivers are now provided with automatic volume control circuits. These are usually so arranged that when the signal strength reaches a high limit, the carrier wave causes the creation of a negative bias sufficient, when imposed upon the control electrode of a previous amplifier tube, to reduce the amplification. Conveniently this negative bias thus created by the carrier wave, is used in this invention, to reduce the energy transmitted to the output of the set, thereby keeping the set inactive. Upon cessation of the carrier wave, the negative bias is no longer created, and energy can flow to the output, as by the aid of a regenerative or feed-back circuit, causing the loud-

2

speaker to produce a tone of a pitch determined by the intensity of the current. Placing the set in a condition to respond to cessation of broadcasting, while yet remaining silent, is simply effected by the aid of a switch. This switch can be placed in a position where the set operates to reproduce the broadcast, or in another position, reducing the flow of energy to the loud speaker, while the set is turned on, and yet conditioning the circuits so that an audible signal is received as soon as broadcasting ceases.

In another form of the invention, the carrier wave operating serves to cause a flow of energy through an amplifier system sufficient to operate a relay. Such a relay may be used to de-energize sources of light automatically, as for black-out purposes.

This invention possesses many other advantages, and has other objects which may be made more readily apparent from a consideration of several embodiments of the invention. For this purpose there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a wiring diagram illustrating one form of the invention; and

Fig. 2 is a fragmentary wiring diagram of a modified form of the invention.

In the present instance, the invention is illustrated in connection with a conventional type of superheterodyne radio receiver. However, the invention may be incorporated in connection with other types of receivers.

The wiring diagram of Fig. 1 shows in general various units of such a conventional superheterodyne receiving system. Thus for example there is illustrated a pickup 1 which may be in the form of an antenna circuit or a loop circuit. This pickup 1 is shown as connected to a tunable radio frequency amplifier system 2. The output of this radio frequency amplifier system is connected to a converter 3 which usually comprises an oscillator and a first detector. The output of the converter is connected to the intermediate frequency amplifier system 4.

Since the particular scheme of connections is unimportant, these various elements 1, 2, 3 and 4 are shown in the form of block diagrams.

The output of the intermediate frequency am-

plifier system 4 is shown as connected to a system 5 that comprises the sound detector as well as a source of automatic volume control voltage. This system 5 is arranged in any well known manner to develop a voltage, usually of negative character, which may be impressed upon the control electrodes of at least some of the amplifier tubes in the preceding stages 2, 3 and 4, for the purpose of limiting the degree of amplification. Since these systems 2, 3, 4 and 5 are provided with ground connections as illustrated, the automatic volume control voltage can be made effective by the aid of a conductor 6 leading from the system 5, and branching off to appropriate amplifier tubes in the systems 2, 3 and 4. This automatic volume control voltage is impressed upon the control electrodes of some of the tubes included in the stages 2, 3 and 4.

While a conventional form of automatic volume control system is indicated, for the purposes of the present invention, a control voltage may be created in any other known manner, by the operation of the carrier wave received by the pick-up system 1.

When the entire system is operating as a conventional radio receiving system, the output of the system 5 may be connected to the input circuit of an audio frequency amplifier 7. This is shown as a conventional triode, although other types of tubes might be utilized. The input circuit of the amplifier tube 7 is connected to the system 5 through a switch 8 located between the control electrode or grid 9 and one of the output leads of the system 5. The cathode 10 of the amplifier 7 is shown as connected to the other output lead of the system 5. The audio frequency amplifier 7 is shown as coupled in any desired manner to the input circuit of a power tube 11, also shown for the sake of simplicity as a triode. The output circuit of the tube 11 includes the primary winding 12 of an iron core transformer 13. The secondary winding 14 is shown as connected to operate a sound reproducer such as the loud speaker 15.

The anodes of tubes 7 and 11 are arranged to be connected to a conventional source of direct current potential, in a well understood manner. Furthermore, the cathodes of both tubes 7 and 11, as well as one of the terminals of the secondary winding 14, are all connected to ground as indicated at 16.

In the normal use of the receiving set, the switch 8 is thrown to the full line position and the set operates in a well understood manner. If, however, the switch 8 is thrown to the dotted line position, reception of a carrier wave maintains the set silent. Upon cessation of the carrier waves, the loud speaker 15 is caused to emit a sound signal. The manner in which this is accomplished will now be described.

Since switch 8, when in the dotted line position, disconnects the input circuit or audio frequency amplifier 7 from the output of the system 5, the set is no longer operative as a conventional receiver set. By placing the switch 8 in the dotted line position so as to connect the control electrode 9 to the conductor 17, this control electrode 9 is biased with the automatic volume control voltage. This biasing is in such a direction, usually negative, as to cause a greatly reduced output voltage across the output circuit of the amplifier 7. Thus the automatic volume control lead 6 is shown as connected by the aid of the conductor 18 and resistance 19 to the connection 17 and by way of switch 8 to the electrode 9. Accordingly while the carrier wave is being received the transmission of signaling impulses is substantially entirely blocked through the amplifier 7. When the carrier wave ceases, however, this blocking potential is no longer created. The amplifier 7 is then rendered sufficiently active to cause oscillations in a regenerative or feed-back circuit. This regenerative circuit includes a coupling between the input of tube 7 and the output of tube 11. This is accomplished by the aid of the connection 20 in which is included a capacitance 21 as well as a variable resistance 22. The regenerative or feed-back coupling thus includes the control electrode 9, the resistance 22, capacitance 21 and the inductance 14. Accordingly when this switch 8 is in the dotted line position and the carrier wave goes off the air, the loud speaker 15 is rendered active by the oscillations of current produced through the cooperation of the regenerative circuit with the tubes 7 and 11.

The pitch and amplitude of the sound produced by the loud speaker 15 when the regenerative circuit is active depends upon the capacity of the capacitance 21 as well as the value of the resistance 22. This may be purposely made adjustable for controlling the feed-back circuit.

The resistance 19 is also indicated as variable. This resistance has no effect upon the biasing voltage applied to the control electrode 9; but together with the resistance 22 it determines the amount of feed-back between the output and input circuits of the system comprising the tubes 7 and 11. In ordinary instances the resistance 19 may be of the order of ten thousand or less ohms and may be as high as one hundred thousand ohms. Similarly the resistance 22 may be of the order of thirty thousand ohms to three million ohms. The capacity of the capacitance 21 may be of the order .001 microfarad to as high as .01 microfarad. Of course these values are dependent to some extent upon the other constants of the system.

It is not essential to utilize a feed-back or regenerative circuit to obtain a signaling or controlling function. Thus in the form of the invention illustrated in Fig. 2, an electromagnetically operated relay mechanism 23 is illustrated. This relay may include front and back contacts 24 and 29. The relay mechanism 23 includes an electromagnet 25 located in the output circuit of a power tube 26. This power tube has its input circuit connected to the output circuit of the amplifier 27. The plate current in tube 27 provides a grid bias for tube 26, as by the aid of the resistances 30, 31, 32.

The amplifier 27 is shown as having a control electrode 28 corresponding to the control electrode 9 of the first form of the invention. The switch 8 in the full line position serves to impress upon the input side of the amplifier 27 the signaling impulses received by the radio receiving set. In the dotted line position the switch 8 connects the electrode 28 to a source of biasing voltage such as the automatic volume control voltage. When the carrier wave is active the plate current in tube 27 is a minimum due to the grid bias on the grid 28. Accordingly, the grid bias on power tube 26 is also a minimum and consequently the current in tube 26 is a maximum and the relay 23 is held in the position indicated, the electromagnet 25 being energized. Should the carrier wave disappear, the current increase in the plate circuit of tube 27 causes an increase of bias on the grid of tube 26 and the resultant decrease in the plate current in tube 26 permits the relay to open.

In this way, a failure in the receiver or its power supply automatically causes the relay 23 to operate, which provides a safety factor.

What is claimed is:

1. In a radio receiving system utilizing a series of electronic emission tubes cooperating with a translating device, each of said tubes having an input side, means responsive to the reception of a carrier wave by said system for creating a potential difference, means for disconnecting the input side of one of the tubes so that the system is rendered incapable of transmitting signaling impulses, and for connecting said input side to the means creating a potential difference, said potential difference, when it exists, being of such direction and value as to block the transmission of energy through said tube, and means cooperating with said tube for causing energization of said translating device upon cessation of said blocking effect.

2. In combination with a radio receiver of the type having a plurality of electronic emission tubes adapted to cooperate with a translating device, each of said tubes having a control electrode, and an automatic volume control by the aid of which a potential difference is created in response to the reception of a carrier wave by said receiver, said potential difference being applied as a control electrode bias to at least one of said tubes ahead of the last tube: means adapted to form a regenerative circuit, including said last tube as well as a circuit controller for optionally connecting the control electrode of said tube with said means, or in signal receiving relation with the other tube or tubes, and means for applying at least a part of said potential difference to the regenerative circuit so as to be effective on the control electrode of said last tube, said potential difference, when it exists, being of such direction and magnitude as to cause a reduction in the supply of signalling voltage to the translating device to render said device substantially inactive, the constants of said regenerative circuit being such that, upon cessation of the carrier wave, the regenerative circuit operatively affects the translating device.

3. In combination with a radio receiver of the type having at least a pair of electronic emission tubes adapted to cooperate with a sound reproducer, each of said tubes having a control electrode: means responsive to the reception of a carrier wave by said receiver for creating a potential difference, and circuit forming means adapted to be connected to the control electrode of one of said tubes, and when so connected serving to apply said potential difference to said electrode, as well as to form a regenerative circuit including said tube, said potential difference, when it exists, being of such direction and magnitude as to cause a reduction in the supply of signalling current to the sound reproducer, said regenerative circuit having constants such that said circuit is effective to energize said sound reproducer only when said potential difference is substantially non-existent.

4. In combination with a radio receiver of the type having at least a pair of electronic emission tubes adapted to cooperate with a sound reproducer, each of said tubes having a control electrode: means responsive to the reception of a carrier wave by said receiver for creating a potential difference, circuit forming means adapted to be connected to the control electrode of one of said tubes, and when so connected serving to apply said potential difference to said electrode, as well as to form a regenerative circuit including said tube, said potential difference, when it exists, being of such direction and magnitude as to cause a reduction in the supply of signalling current to the sound reproducer, said regenerative circuit having constants such that said circuit is effective to energize said sound reproducer only when said potential difference is substantially non-existent, and a common circuit controller for optionally connecting said electrode with said circuit forming means, as well as for causing said potential difference to become effective on said electrode, or to receive signalling current from a preceding tube.

5. In combination with a radio receiver of the type having a series of electronic emission tubes adapted to cooperate with a sound reproducer, each of said tubes having a control electrode and an anode, said receiver also having an automatic volume control responsive to the existence of a carrier wave to apply a potential difference on at least one of said tubes ahead of the last tube of the series, for limiting the volume: a pair of circuit forming means optionally rendered effective, one circuit of said pair serving to transmit signalling impulses in a normal manner to said last tube, the other circuit serving to impress at least part of said potential difference on one of said tubes beyond the said prior tube or tubes, said potential difference, when it exists, being of such direction and magnitude as to render said one tube ineffective to cause operation of the sound reproducer, said other circuit including a connection between the control electrode and the anode of said tube for causing said tube to oscillate and cause operation of the sound reproducer when said potential difference is non-existent due to the cessation of the carrier wave.

6. In combination with a radio receiver of the type having a series of electronic emission tubes adapted to cooperate with a sound reproducer, each of said tubes having a control electrode and an anode, said receiver also having an automatic volume control responsive to the existence of a carrier wave to apply a potential difference on at least one of said tubes ahead of the last tube of the series, for limiting the volume: a circuit forming means including a circuit controller and adapted to connect said volume control means to the control electrode of one tube of said series beyond those having automatic volume control, said connection serving to impress a biasing potential sufficient, while the carrier wave exists, to render said one tube ineffective to cause operation of said sound reproducer, and means forming a regenerative circuit including said one tube, and causing, during cessation of said carrier wave, oscillations that operate the sound reproducer.

7. In signalling apparatus utilizing a series of electronic emission tubes adapted to cooperate with a translating device, at least one of said tubes having a control electrode, said tube being unable to transmit amplified signalling impulses of a carrier wave received by said apparatus to said translating device, means operative to create a potential difference in response to the reception of said carrier wave, and means optionally connecting said control electrode to a signal translating circuit or to said potential difference creating means for impressing said potential difference upon said control electrode, said potential difference, when it exists, being of such direction and magnitude as to block transmission of energy through said tube to the translating device,

and ineffective to block such transmission when the carrier wave ceases.

8. In signalling apparatus utilizing a series of electronic emission tubes adapted to cooperate with a translating device, at least one of said tubes having a control electrode, said tube being unable to transmit amplified signalling impulses of a carrier wave received by said apparatus to said translating device, means operative to create a potential difference in response to the reception of said carrier wave, means optionally connecting said control electrode to a signal translating circuit or to said potential difference creating means for impressing said potential difference upon said control electrode, said potential difference, when it exists, being of such direction and magnitude as to block transmission of energy through said tube to the translating device, and ineffective to block such transmission when the

carrier wave ceases, and means cooperating with said tube capable of effectively energizing said translating device when said blocking effect ceases.

LOUIS B. BRITTAIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,489,158	Schaffer	Apr. 1, 1924
1,522,581	Espenschied	Jan. 13, 1925
2,125,468	Sinninger	Aug. 2, 1938
2,156,809	Fredrickson	May 2, 1939
2,200,037	Mountjoy et al.	May 7, 1940
2,204,962	Hildebrandt	June 18, 1940
2,367,378	Schick	Jan. 16, 1945