May 12, 1931. H. B. COXHEAD 1,804,526

RADIO RECEIVING CIRCUIT

Filed Sept. 1, 1926

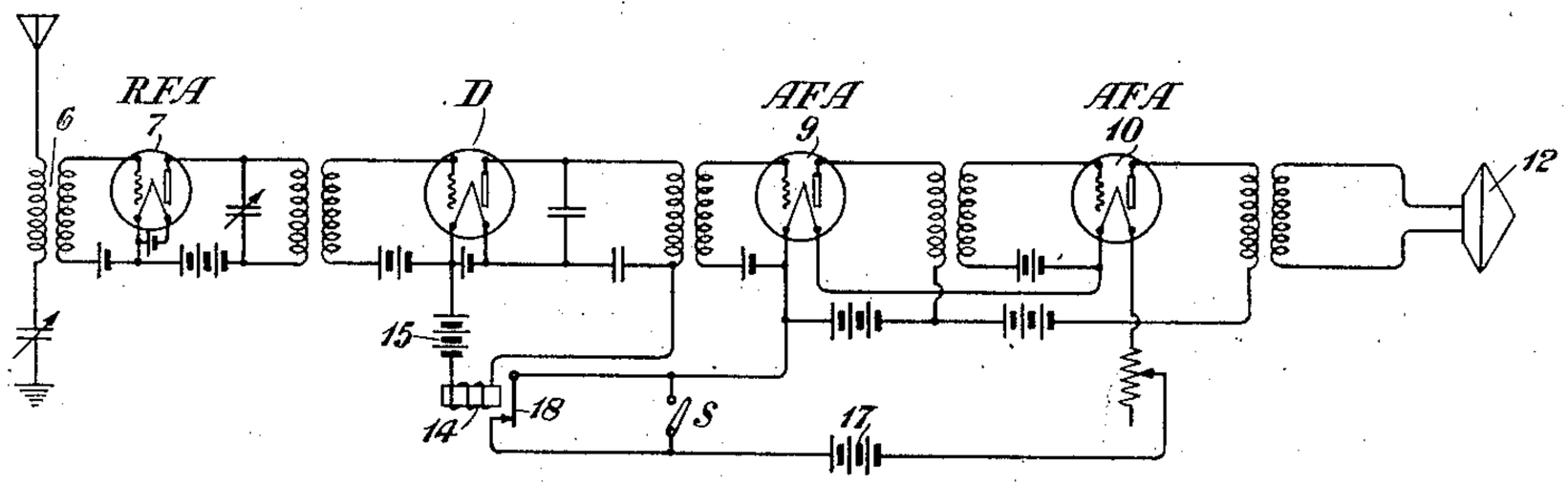

Fig. 1

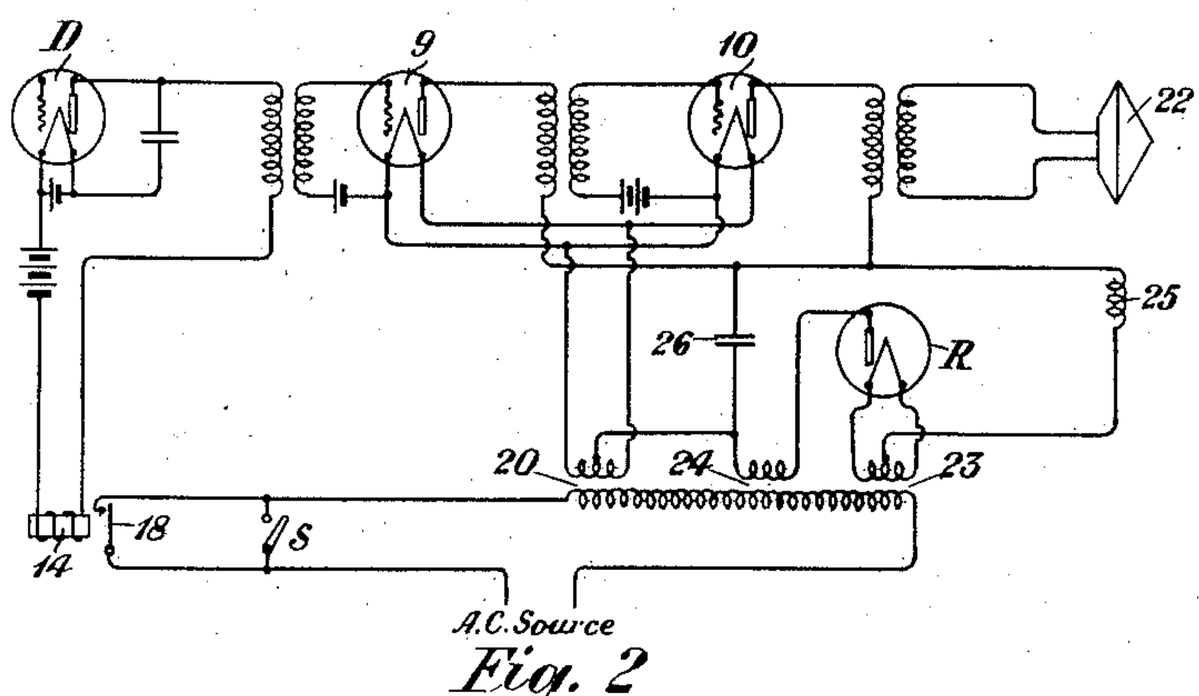

Fig. 2

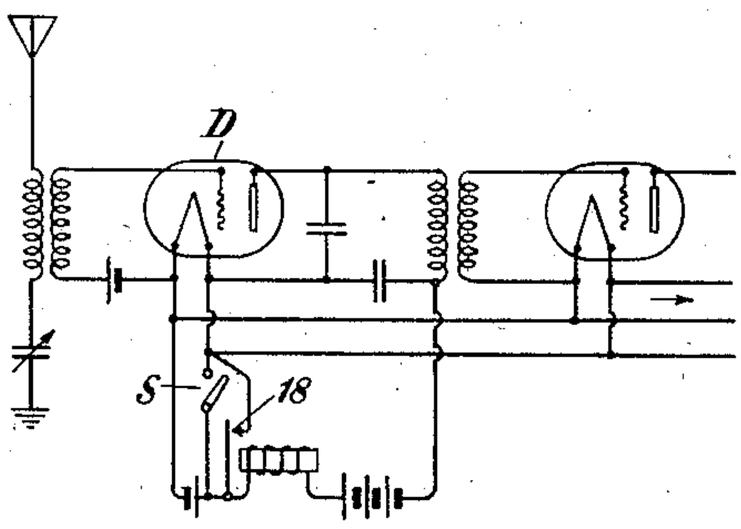

Fig. 3

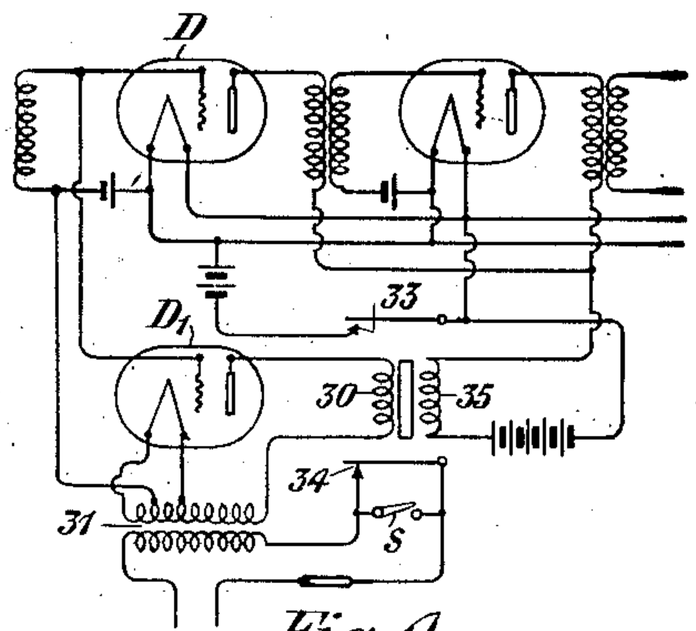

Fig. 4

INVENTOR
H. B. Coxhead

BY

ATTORNEY

Patented May 12, 1931 1,804,526

UNITED STATES PATENT OFFICE

HARRY B. COXHEAD, OF HOLLIS, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK

RADIO RECEIVING CIRCUIT

Application filed September 1, 1926. Serial No. 133,035.

This invention relates to a radio receiver circuit and more particularly to an automatic switching means for the purpose of putting in operation certain parts of the receiver circuit, such as the audio-frequency amplifier, when the radio message is received, and for shutting off such parts when the radio message no longer arrives.

It frequently occurs that one desires to have a radio receiver ready at all times to respond to radio signals without the need of immediate personal attention. This, of course, is possible in general but it means the continuous use of power for the lighting of vacuum tube filaments and for the supply of plate circuits which in some cases is an inconvenience and a substantial expense. In this invention I propose to make use of the difference in the space current in a vacuum tube detector or rectifier when a carrier wave is being received over that when no such wave is present. More particularly, I propose to use this change to control a relay, which in turn controls the power delivered to the receiving circuit or any part thereof. The invention will be better understood by reference to the following description taken in connection with the accompanying drawing in which Figure 1 shows one circuit arrangement for applying the invention and Figs. 2, 3 and 4 are modifications thereof.

Referring more specifically to Fig. 1, there is shown at 6 a receiving antenna associated with a vacuum tube 7, adapted to amplify radio frequencies as indicated by the reference letters RFA and in turn associated by properly tuned circuits with a detector tube D. The audio-frequency message resulting from this detection may in turn be amplified by any suitable number of stages of amplification. In this case, for illustrative purposes, I have shown two amplifiers 9 and 10 with their properly associated circuits but it is to be understood that any other number of the amplifiers may be connected in any manner now well understood in the art. In this figure, I have also shown the last stage of amplification as supplying power to a loud speaker 12. Throughout this circuit, it is to be understood that suitable power will be supplied both for lighting the filaments and for impressing proper voltages in the plate circuits.

In the plate circuit of the detector D, there is included the winding of a marginal relay 14 in such manner that the direct current delivered by the plate battery 15 will flow through said relay 14. The filaments of the amplifying tubes 9 and 10 are shown connected in series and lighted by the battery 17; this circuit being controlled by the contact points 18 of the relay 14.

The operation of the circuit is as follows: Normally, a space current of a certain value flows through the detector tube D and the relay 14 from the battery 15. The relay is adjusted so that with this current the contact 18 is open. Upon receipt of the carrier wave to which the antenna system is tuned, the space current flowing through the tube D will be altered. In some cases, this change will be an increase and in some cases a decrease, this depending upon the characteristic of the detector tube and its circuit. If we take the case where there will be an increase in the average space current flowing the relay would be so adjusted that when this change occurs, the contact points at 18 will be closed, whereupon the filaments of the tubes 9 and 10 will be lighted, thus bringing these tubes into operation. When the carrier wave ceases to arrive the reverse change occurs in the space current of the tube D, the relay 14 immediately releases its armature, opening the lighting circuit of the tubes 9 and 10 and thus stopping the flow of power from the battery 17 as well as from the batteries in the plate circuits of these tubes. It will be noted that the circuit as arranged leaves the tube 7 and the tube D in operation continuously so that the set, as a whole, is ready to receive signal at any time that the proper carrier wave arrives, but since in many such circuits the larger portion of the power supplied is for the circuits subsequent to the detector, there will result a substantial saving in power and in the life of various elements making up the circuits. It is obvious that while one stage of radio amplification has been shown addi-

tional stages might be used or the one stage shown might be eliminated without altering the manner in which the circuit operates. Also, a switch S has been shown in the filament circuit of the tubes 9 and 10 which switch may be closed at any time desired to short circuit the contacts 18 and thus maintain the filament circuit in normal operation independently of the transmitting station.

Fig. 2 shows a modification of the circuit of Fig. 1, in this case, the filaments of the tubes 9 and 10 being supplied by an A. C. source through a transformer 20, the transformer circuit being controlled by the relay 14 in the manner already described. This figure shows a rectifier R by means of which A. C. power is rectified for the plate circuits of these tubes. Any well known method of filtering, indicated by the retardation coil 25 and the condenser 26, may obviously be associated with this rectifier circuit to smooth out the current delivered by it. In this circuit it will be noted that each of the secondary windings 20, 23 and 24 are supplied from a single primary winding, the circuit of this primary being controlled by the contacts 18, however, separate transformers may be used controlled by the relay 14. Also, as in Fig. 1, a switch S is shown to control this circuit independently of the relay.

Here, again, a detector tube D is shown as being normally in operation, even though subsequent circuits may be dead, but it is apparent that the circuit may be modified to control even the detector tube circuit, itself. This is shown in Fig. 3 where the contacts 18 control the filament circuit of the detector D as well as the filament circuits of the subsequent tubes. In this case when the desired carrier wave ceases to arrive, the whole receiving circuit becomes dead and the later receipt of the carrier wave will not bring the circuit into commission automatically but by means of the switch S this may be done manually; and after the carrier wave has commenced to arrive, this switch may be opened, whereupon the relay will maintain the circuits in operative condition until cessation of the carrier wave.

Fig. 4 shows a further modification, in which provision is made for maintaining a receptive device, which latter is supplied by a cheap source of power and which may be maintained in operation at all times, but which will not be introduced into the receiving circuit proper with the accompanying disturbances likely to be present with such a source. In this figure there is shown, in parallel to the detector D of the receiving circuit proper, a second detector or rectifier tube D_1, the output circuit of which includes one winding 30 of a relay. This detector tube may be maintained in operation by a transformer 31 supplying power to the filament and the plate circuit. Upon receipt of carrier wave, the change in current through the winding 30 will close the contact 33, this contact being in the battery circuit of the filaments of the tube D and subsequent amplifying tubes, and closing of this contact will place the receiving circuit in operation, as described in the previous figures. It may be desirable, in addition, to render this rectifier circuit inoperative during actual reception of signals and thus prevent disturbances from the A. C. source and to save this auxiliary power. To this end, a second contact 34 is also operated by winding 30, thus opening the primary circuit of the transformer 31. This in itself, however, would release the contact 33, and to prevent this, a second winding 35 is provided for the relay. This will maintain the contact 33 and will also hold the contact 34 in open condition. Upon cessation of carrier wave, the current through winding 35 will change, the contact 33 will open, and the contact 34 will close, thus again bringing the tube D_1 with its associated circuit into normal "stand-by" condition.

The detector D_1 is shown in parallel to detector D but it should be understood that various equivalent arrangements may be used, for example, D_1 may have a separate transformer on the same antenna or an entirely separate antenna system, and in either case, it may be tuned to the same frequency as the receiving set or to a different frequency.

While I have described this invention in connection with certain specific circuits, it is apparent that numerous modifications and changes may be made without departing from the spirit of my invention.

What is claimed is:

1. In a high frequency signaling system, a transmitting station and a receiving station, a detecting device and amplifying device in the receiver circuit, a relay in the circuit of said detecting device adapted to close the power circuits for the amplifying device during reception of the desired radio carrier wave and to open said power circuits when no such carrier wave is being received.

2. In a high frequency signaling system, a transmitting station and a receiving station, a detecting device and amplifying device in the receiving circuit, a relay in the output of said detecting device adapted to operate on a change in current through the detecting device when the desired carrier wave is being received and thereby control the power supplied to the amplifying device.

3. In a high frequency signaling system, a transmitting station and a receiving station, a plurality of thermionic tubes in the receiving circuit, a relay in the output circuit of one of said tubes adapted to operate on a

change in space current of the tube when the desired carrier wave is being received and to thereby control the power supplied to the tubes subsequent to the first named tubes.

4. In a high frequency signaling system, a transmitting station and a receiving station, a thermionic detector in the receiving circuit, amplifier tubes for the output of said detector, a relay in the output circuit of the detector adapted to maintain the power circuits subsequent to the detector closed during the reception of the desired carrier wave and to open said circuits when no such carrier is being received.

5. In a high frequency signaling system, a transmitting station and a receiving station, a thermionic detector in said circuit, amplifier tubes for the output of said detector and a loud speaker associated therewith, a relay in the output circuit of the detector adapted to maintain the power circuits subsequent to the detector closed during the reception of the desired carrier wave and to open such circuits when no such carrier is being received.

6. In a radio signaling system, a radio receiving station comprising vacuum tubes supplied with power from a local source, the method of reception which consists in leaving some of the vacuum tubes normally without power and at least one connected with power and connecting the first named tubes to the power source automatically upon and by the change in current in a connected tube due to the receipt of the radio message to be received.

7. In a radio signaling system, a radio receiving station comprising vacuum tubes supplied with power from a local source, means for connecting at least one of said tubes permanently to said power source, means for connecting or disconnecting some of said tubes from said power source, the last-named means being controlled upon and by change in space current in a connected tube on receipt of signal current to connect the disconnected tubes.

In testimony whereof, I have signed my name to this specification this 30th day of August, 1926.

HARRY B. COXHEAD.

DISCLAIMER

1,804,526.—*Harry B. Coxhead*, Hollis, N. Y. RADIO RECEIVING CIRCUIT. Patent dated May 12, 1931. Disclaimer filed March 16, 1934, by the assignee, *American Telephone and Telegraph Company*.

Hereby enters this disclaimer to claims 1, 2, 3, 4, 6 and 7 of said Letters Patent, to wit:

"1. In a high frequency signaling system, a transmitting station and a receiving station, a detecting device and amplifying device in the receiver circuit, a relay in the circuit of said detecting device adapted to close the power circuits for the amplifying device during reception of the desired radio carrier wave and to open said power circuits when no such carrier wave is being received.

"2. In a high frequency signaling system, a transmitting station and a receiving station, a detecting device and amplifying device in the receiving circuit, a relay in the output of said detecting device adapted to operate on a change in current through the detecting device when the desired carrier wave is being received and thereby control the power supplied to the amplifying device.

"3. In a high frequency signaling system, a transmitting station and a receiving station, a plurality of thermionic tubes in the receiving circuit, a relay in the output circuit of one of said tubes adapted to operate on a change in space current of the tube when the desired carrier wave is being received and to thereby control the power supplied to the tubes subsequent to the first named tubes.

"4. In a high frequency signaling system, a transmitting station and a receiving station, a thermionic detector in the receiving circuit, amplifier tubes for the output of said detector, a relay in the output circuit of the detector adapted to maintain the power circuits subsequent to the detector closed during the reception of the desired carrier wave and to open said circuits when no such carrier is being received.

"6. In a radio signaling system, a radio receiving station comprising vacuum tubes supplied with power from a local source, the method of reception which consists in leaving some of the vacuum tubes normally without power and at least one connected with power and connecting the first named tubes to the power source automatically upon and by the change in current in a connected tube due to the receipt of the radio message to be received.

"7. In a radio signaling system, a radio receiving station comprising vacuum tubes supplied with power from a local source, means for connecting at least one of said tubes permanently to said power source, means for connecting or disconnecting some of said tubes from said power source, the last-named means being controlled upon and by change in space current in a connected tube on receipt of signal current to connect the disconnected tubes."

[*Official Gazette April 10, 1934.*]