

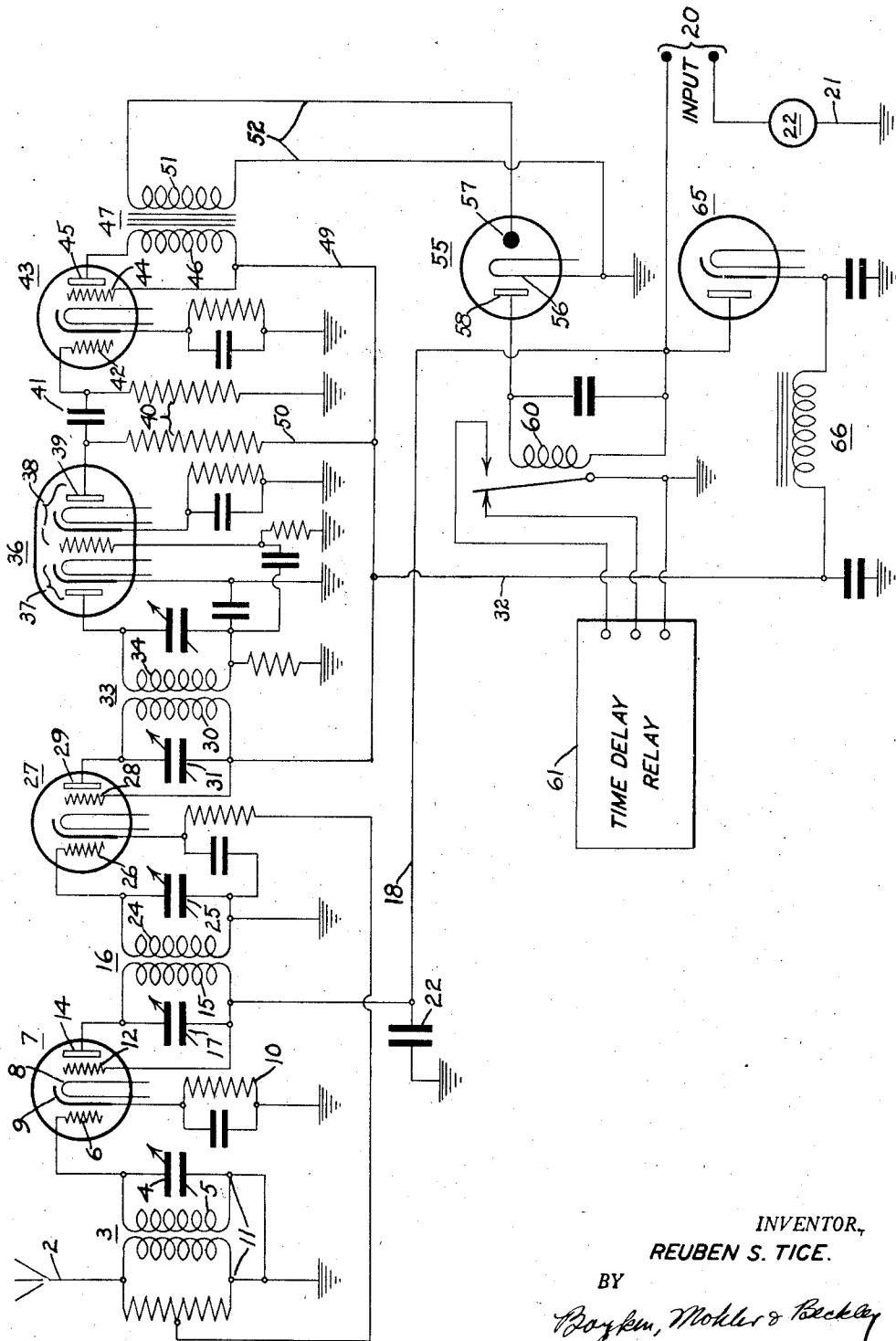
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RADIO REMOTE CONTROL RECEIVER

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RADIO REMOTE CONTROL RECEIVER

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My invention relates to radio remote control receivers, and is particularly applicable for use as an alert receiver operating in accordance with the operating conditions of a radio transmitter, either continuous wave or voice modulated.

Among the objects of my invention are: To provide a radio receiver that is capable of automatically operating a relay when a radio transmitting station either goes off the air, or transmits a warning signal including interruption of transmission; to provide such a system which does not rely upon any modulated output of the radio transmitter; to provide a relay operating radio receiver that is automatically resetting, and which can operate untended in accordance with the interruptions of a radio signal; to provide an alert receiver capable of operating an alarm or controlling lights upon interruption or cessation of a signal from the radio station to which the receiver is tuned; to provide such a receiver having reliable output power capable of operating relays, with a minimum of interference from static conditions and from minor and accidental interruptions of the radio transmitter; and to provide a relatively simple and powerful remotely controlled radio receiver.

My invention possesses numerous other objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing my novel method. It is, therefore, to be understood that my method is applicable to other apparatus, and that I do not limit myself in any way to the apparatus of the present application, as I may adopt various other apparatus embodiments utilizing the method, within the scope of the appended claims.

There are many radio receivers available today, which are primarily designed as remotely controlled receivers operating as alert alarms, for example, in accordance with a signal from local broadcast, police or special emergency stations. Such receivers, however, practically invariably operate by virtue of the modulated component of the local radio station output. When continuous wave operation is utilized, rather complicated circuits are required, and usually special transmitting stations.

My present invention, however, greatly increases the reliability of operation of remotely controlled receivers. In broad terms, my invention includes the use of a radio receiver having radio-frequency amplifier stages, one or more of which, preferably the first, is supplied with audio-frequency from a local oscillator or local power

mains, so that all the radio-frequency energy received is modulated at the receiver at control signal frequency. This locally modulated radio-frequency may then be further amplified, detected and amplified as audio power, and the output passed to a trigger tube such as a "Thyratron," whose anode is also supplied by the local control signal frequency.

The output of the trigger tube may then be used to actuate a relay, and preferably a relay having a certain amount of time delay. The output relay may be operated either directly from the trigger tube or through the medium of more sensitive relay acting directly from the output of the trigger tube. In this manner, the entire amplitude of received and amplified energy is available for actuating the trigger tube.

When transmission from the transmitter to which the receiver is tuned ceases, the receiver immediately ceases operation, because the control signal frequency cannot be amplified in the radio-frequency stages following the modulator stage. The trigger tube, therefore, also immediately ceases operation upon cessation of transmission from the radio transmitter operating the relay. However, upon resumption of the transmitter the entire set becomes active again, the trigger tube is operated, and the work circuit conditions are immediately reversed.

The entire operation is automatic, the receiver can be placed in distant locations without supervision, and if desired, the receiver output can be coded to perform special duties, although such a coding system is no part of the present invention.

In the drawing, the figure is a circuit diagram showing one manner by which a receiver may be modulated by a local alternating current such as, for example, from the local alternating power mains, to produce reliable and accurate control of an output relay.

Referring, therefore, directly to this diagram for a more detailed description of my invention, a radio receiver is provided with the customary type of antenna 2 and connected to a radio-frequency input transformer 3 tuned, as is customary, by variable capacity 4, the secondary 5 of the transformer energizing grid 6 of a first radio-frequency amplifier and modulator tube 7, preferably of the type having a heater 8, and an indirectly heated cathode 9 grounded through biasing circuit 10.

The radio-frequency transformer 3 is provided with the usual grounded primary and secondary terminals 11. Screen 12 and anode 14 of tube 7

are joined through the primary 15 of a second radio-frequency transformer 16 and connected to anode supply and control frequency line 18. Primary 15 is tuned by condenser 17, and screen 12 and anode 14 are directly connected through primary 15 to the control frequency line 18 to one side of A. C. mains 20, the other side 21 of these mains being grounded through a control switch 22. Line 18 is also grounded through radio-frequency by-pass condenser 22. Secondary 24 of radio-frequency transformer 16 is tuned by variable capacity 25 and one side of secondary 24 is led to grid 26 of the second radio-frequency amplifier tube 27, the screen 28 and anode 29 of this tube being joined by inductance 30 tuned by variable capacity 31 and connected to supply line 32.

The inductance 30 of the tuned anode circuit forms the primary of a third radio-frequency transformer 33, the secondary 34 of which is connected to a combined detector and first audio amplifier tube 36, comprising diode detector elements 37 and amplifier elements 38 coupled thereto, as is well known in the art.

Output anode 39 of the amplifier section 38 is resistance coupled by resistors 40 and capacity 41 to the grid 42 of audio amplifier tube 43, the screen 44 and anode 45 of which are connected together through the primary 46 of an audio-frequency transformer 47, the screen and anode potential being supplied by connections from anode supply line 32 through lead 49. Anode 39 of tube 36 amplifier section 38 is similarly supplied through line 50.

Secondary 51 of audio-frequency transformer 47 is connected through output circuit 52 to a trigger or "Thyratron" tube 55, one side of circuit 52 being connected to cathode 56 of this trigger tube, the other side of the circuit being connected to the firing electrode 57 of this tube. Anode 58 of the trigger tube is supplied with alternating current at control signal frequency from mains 20 through a relay winding 60, which controls any type of load circuit desired. Such load circuit may include a time delay relay 61 which may in turn control a coding circuit (not shown), all depending upon the use to which the receiver is to be put.

Anode potential for the receiver proper is obtained, as is customary, by the use of rectifier 65 supplying current to anode supply line 32 through the filter circuit 66.

In operation, the radio-frequency circuits are tuned to the frequency of a radio transmitter station by their variable capacities which may, if desired, be linked. The radio transmitting station may be a continuous wave station, or may be voice modulated such as, for example, a broadcast station. The received radio-frequency is amplified in tube 7, but the alternating current energization of the plate of this tube by the control signal frequency from mains 20 causes the incoming radio-frequency to be completely interrupted or modulated at control signal frequency in the output of this tube. This locally modulated radio-frequency is then amplified in radio-frequency amplifier 27, detected in portion 37 of tube 36, amplified as audio-frequency in the audio-frequency portion 38 of tube 36, and still further amplified in audio-frequency amplifier tube 43, so that the output of transformer 47 is, while the receiver is receiving radio-frequency from the transmitter, alternating current only at control signal frequency. This alternating current is then passed to the trigger tube, the an-

ode of which is also supplied with alternating current from the control signal frequency mains 20.

The trigger tube will fire or ignite to pass current whenever the audio-frequency output of transformer 47 is positive coincidentally with the positive excitation of the trigger tube anode, which will be during the time radio-frequency is being received, and amplified in first radio-frequency amplifier and modulator tube 7. When, however, radio-frequency is no longer being received by antenna 2, due to cessation or interruption of the radio station to which the receiver is tuned, the control signal frequency continuing in the primary 15 of second radio-frequency transformer 16 cannot modulate any radio-frequency, as tube 7 will not be operating. Consequently, no amplification of any kind can take place in tube 27, or in the remainder of the system. The trigger tube, therefore, at once loses its igniting potentials and ceases operation. The time delay relay when used, will operate, providing the interruption is longer than the time delay built into the relay.

The principal reason for using a time delay relay in a system of this character, is to eliminate any possibility of operation of such relay controlled circuit when short and accidental interruptions take place in the output of the radio transmitter to which the receiver is tuned.

At any time after the receiver has once ceased operation because of lack of input radio-frequency, this input is again received, the entire set will again pass the locally modulated current, the trigger tube will again be energized, and the time delay relay 61 will operate by virtue of the output of the trigger tube and the energization of relay 60. Thus, the time delay relay will automatically operate in both directions, according to the radio-frequency reception.

It will be noted that there are many advantages inherent in the circuit just above described. In the first place, the receiver will operate to control relay 60 on either a broadcast station when it is being voice modulated or on the same broadcast station without voice modulation. In a like manner the receiver will operate from a station which is adapted to emit continuous waves only under interruption control.

Furthermore, inasmuch as the radio-frequency circuits are made tunable, the receiver is operative throughout its range on any radio station to which it may be tuned, irrespective of whether the station is voice modulated or not. No dependence need be placed upon the modulated component of the received radio-frequency wave and, in fact, all of the energy of the received wave is available as a signal to be modulated, amplified, rectified, and further amplified as audio-frequency for use in operating the trigger tube.

The receiver is positive in action, is not operable by any usual static conditions. Even if static should be at times sufficiently strong to blank out the operation of the first radio-frequency amplifier modulator tube 7, the time delay relay can be set to take care of such momentary interruptions. Obviously, also, the relay 60 can be utilized to either energize or de-energize the time delay relay 61, either in phase with the energization or de-energization of trigger tube 55 or in opposite phase.

Inasmuch as the receiver becomes completely inoperative or completely operative in accordance with the on or off conditions of a distant

radio transmitter, the time delay relay 61 can be utilized to operate a coding device in accordance with the type and sequence of coded signals received by antenna 2 providing only, of course, that such coding signals shall be timed properly so that they will not interfere with the time delay response of relay 61.

It will thus be seen that I have provided a very simple and reliable manner of rendering a radio receiving circuit completely operative, or completely inoperative in accordance with the operating conditions of a distant radio set whether this radio transmitter be voice modulated or unmodulated at the transmitter, by using local modulation of the received wave at a relatively low control frequency. The receiver is completely unresponsive to the control signal alone. Consequently, while I have shown one particular circuit by which this result can be accomplished, I do not wish to be limited to the particular means and method of modulating tube 7 nor to the particular type of following circuits shown, as it will be obvious to those skilled in the art that other means and methods of modulation are fully equivalent, and that other types of control signal exclusion circuits may be used to obtain the same result.

Having described my invention, I claim:

1. A radio receiver controllable in accordance with the transmission from a radio transmitter, a radio-frequency responsive tube, means for energizing said tube with a radio-frequency signal transmitted by said transmitter, a local source of relatively low control frequency oscillations connected to modulate the output of said radio-frequency responsive tube, a radio-frequency amplifier tube responsive to the received radio-frequency signal frequency only, means for detecting and amplifying at control signal frequency the output of said radio-frequency amplifier tube, a trigger tube having an output electrode and a firing electrode, means for applying said control signal directly to said output electrode, and means for applying said rectified and amplified control signal to said firing electrode.

2. A radio receiver controllable in accordance with the transmission from a radio transmitter, a radio-frequency responsive tube, means for energizing said tube with a radio frequency signal transmitted by said transmitter, a local source of relatively low control frequency oscillations connected to modulate the output of said radio-frequency responsive tube, a radio-frequency amplifier tube responsive to the received radio-frequency signal frequency only, means for detecting and amplifying at control signal frequency the output of said radio-frequency amplifier tube, a trigger tube having an output electrode and a firing electrode, means for applying said control signal directly to said output electrode, means for applying said rectified and amplified control signal to said firing electrode, and a work circuit controlled by current delivered by said output electrode.

3. A radio receiver controllable in accordance

with the transmission from a radio transmitter, a radio-frequency responsive tube, means for energizing said tube with a radio-frequency signal transmitted by said transmitter, a local source of relatively low control frequency oscillations connected to modulate the output of said radio-frequency responsive tube, a radio-frequency amplifier tube responsive to the received radio-frequency signal frequency only, means for detecting and amplifying at control signal frequency the output of said radio-frequency amplifier tube, a trigger tube having an output electrode and a firing electrode, means for applying said control signal directly to said output electrode, means for applying said rectified and amplified control signal to said firing electrode, a work circuit controlled by current delivered by said output electrode, and a relay operated by current delivered by said output electrode.

4. In a radio receiver having a vacuum tube amplifier stage responsive to received radio-frequency only, detecting and audio-frequency amplifying stages, means for receiving a radio-frequency signal from a radio transmitter, means for modulating said received signal after reception thereof with audio-frequency control signal means for energizing said vacuum tube amplifier stage with said modulated signal, a trigger tube having an output electrode and a firing electrode, means for applying said control signal directly to said output electrode, and means for applying said rectified and amplified control signal to said firing electrode.

5. In a radio receiver having a vacuum tube amplifier stage responsive to received radio-frequency only, detecting and audio-frequency amplifying stages, means for receiving a radio-frequency signal from a radio transmitter, means for modulating said received signal after reception thereof with audio-frequency control signal means for energizing said vacuum tube amplifier stage with said modulated signal, a trigger tube having an output electrode and a firing electrode, means for applying said control signal directly to said output electrode, means for applying said rectified and amplified control signal to said firing electrode, and a work circuit controlled by current delivered by said output electrode.

6. In a radio receiver having a vacuum tube amplifier stage responsive to received radio-frequency only, detecting and audio-frequency amplifying stages, means for receiving a radio-frequency signal from a radio transmitter, means for modulating said received signal after reception thereof with audio-frequency control signal means for energizing said vacuum tube amplifier stage with said modulated signal, a trigger tube having an output electrode and a firing electrode, means for applying said control signal directly to said output electrode, means for applying said rectified and amplified control signal to said firing electrode, a work circuit controlled by current delivered by said output electrode, and a relay operated by current delivered by said output electrode.

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