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RADIO PROGRAM DETECTOR

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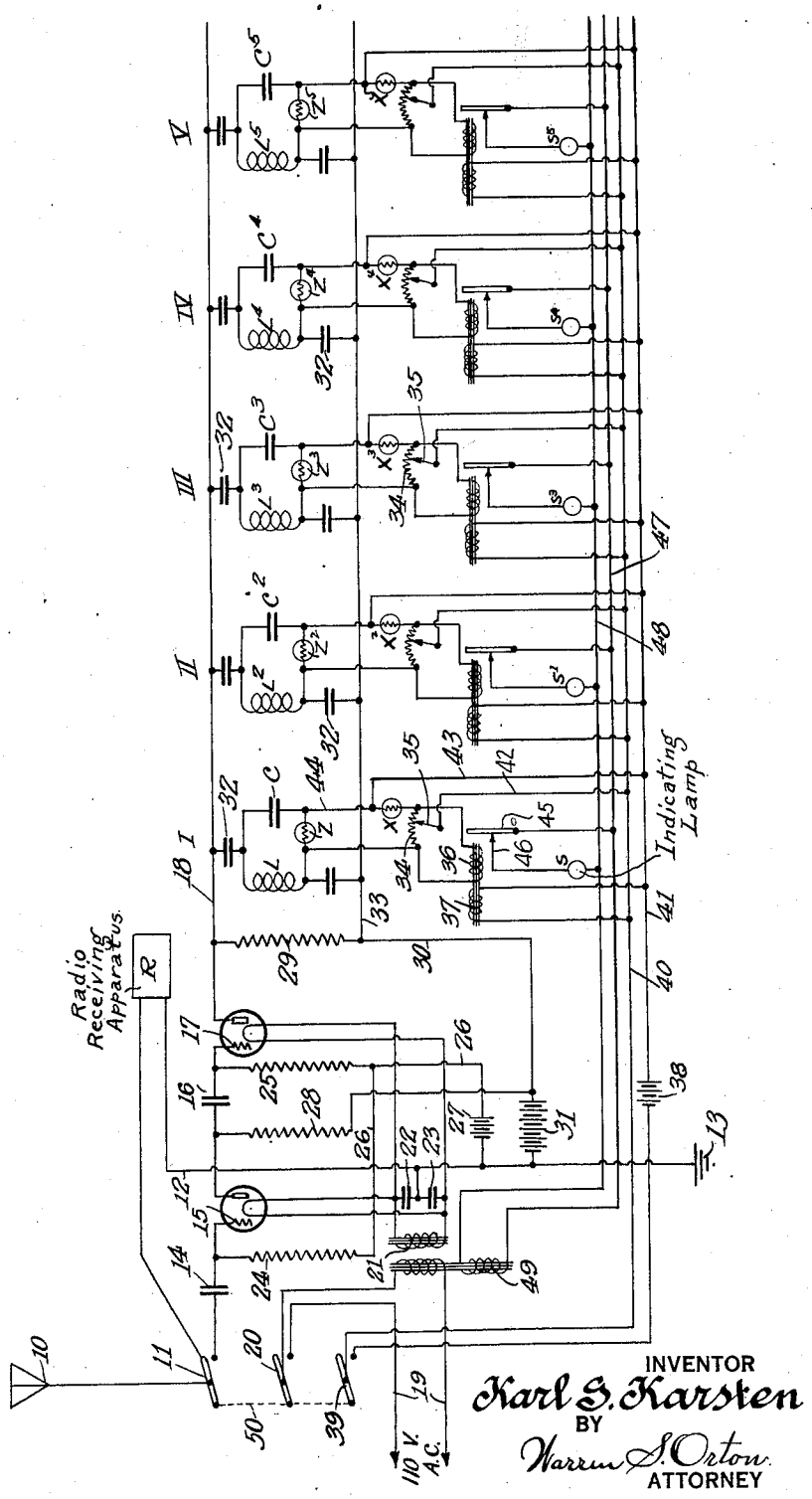

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RADIO PROGRAM DETECTOR

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This invention relates to improvements in apparatus for indicating the reception of radio oscillations at different wave-lengths, so that the operator of a radio set can in a moment's time determine at what wave-lengths stations are transmitting at that instant.

Describing the apparatus generally, it has a switch device which permits the connection of the usual antenna of a radio set to an untuned amplifying and detecting arrangement, and a plurality of indicating systems, each having a circuit connected to such amplifying and detecting arrangement, and tuned to a particular band of wave-lengths which it may be desired to indicate, each having a control relay actuated by currents from its particular tuning circuit, and each having an indicator governed or controlled by its respective relay.

One form of execution of the object of this invention is set forth on the accompanying drawings, in which the figure represents the circuit diagram for such an indicating device for five bands of wave-lengths.

Since this apparatus is intended for use in conjunction with a radio receiving apparatus, a single aperiodic antenna 10 is provided for both devices, with a lead-in to the blade of a two point switch 11; from one point of this switch a conductor leads to the radio receiving set R, with a return by wire 12 to the ground at 13. The other point of the switch 11 is connected through a blocking condenser 14 to the grid of an amplifying tube 15. The anode of this tube 15 is connected through the blocking condenser 16 with the grid of a second amplifying tube 17, which in turn is connected by bus wire 18 to the series of tuning circuits as will be described hereinafter.

Alternating current supply mains 19 are employed as a source of current for the filaments of the tubes 15 and 17. A switch 20 is connected in series with these mains with a line passing through the primary of a transformer 21. A secondary of this transformer 21 is connected to the filaments of the tubes 15 and 17, which are shown as connected in multiple, with the stopping condensers 22 and 23 connected in shunt to the filaments, and with the middle point between the condensers connected to the ground bus 12; this permits the use of alternating current for heating the tubes without setting up an alternating current hum from the power line.

A resistance coupling is indicated between the various circuits across the tubes, since this has been found in practice to be well adapted for the purpose of maintaining an untuned and unselective amplification. The grid leap resistances 24, 25, are connected at one end of each to the grid of the respective tubes 15 and 17 and are connected together at their other terminals by a wire 26, which is continued to the negative terminal of a biasing battery 27, which has its positive terminal connected to the ground bus 12.

It will be understood by a person skilled in the art that when the switches are thrown, by means of the common connection 50, to the lower position, that the circuits are so connected that the signal oscillations of any and all frequencies within the range of the apparatus, as received at the antenna, are amplified and delivered to the bus wires 18, 33 in the output circuit of tube 17.

A plurality of tuned circuits, each preferably having two inductances and capacities of a fixed value so that each circuit is in resonance to a narrow band of frequencies different from those of the other circuits but within a selected broad band of wave-lengths, are connected across the bus wires 18, 33; five of these are represented in the drawings as I, II, III, IV, V and since they are similar except for the constants of value of inductances and capacities, the description of one will suffice for all. With a wave-length range of from 220 to 570 meters, for

example, each of the circuits is constructed and tuned so that it will respond for its due proportion of the range, preferably with a slight overlap at each end of the respective range; thus with ten such circuits, each may be designed for a range of around 35 meters.

Each of these circuits has a tuned oscillatory circuit consisting of the inductance L and the condenser C, connected in series with a resistor Z. This resistor Z is preferably constructed of a material having a high coefficient of thermal change of conductivity, such as tungsten, which for the reduction of heat losses is enclosed in an evacuated tube; a low candle power tungsten lamp bulb may be employed. This oscillatory circuit is connected across the bus wires 18, 33 through the stopping condensers 32 which serve to prevent the flow of direct current through the inductance L which is in shunt to the coupling resistance 29.

The resistor Z constitutes one arm of a Wheatstone bridge, which has a balancing arm including the similar resistor X, and a pair of arms constituting the potentiometer 34, with the movable contact 35 to adjust the ratio of the arms in regulating the device at first setting. Connected across the bridge in shunt to each pair of arms is a winding of a balanced relay here diagrammatically represented as a solenoid 36, mounted upon a common core with a second winding likewise represented as a second solenoid 37, which is traversed by direct current from a battery 38, as controlled from a switch 39, and flowing through the relay energizing bus wires 40, 41. A conductor 42 leads from the movable contact 35 of the potentiometer to the bus wire 40, and the Wheatstone bridge is completed by the conductor 43 extending from the wire 44 connecting the two resistors Z and X to the bus wire 41. The core of the solenoids 36 and 37 actuate an armature 45, when current flows through the solenoid 36, to bring it into conductive relation with the contact 46. The armature is connected to a bus wire 47, and the contact is connected through an indicating device S shown as an electric lamp, to the bus wire 48. These bus wires 47, 48 are connected to the terminals of a secondary 49 in inductive relation with the primary of the transformer 21, so that the current for lighting the lamp bulb S is derived from the alternating current mains.

The operation of each of the other indicating systems II, III, IV, and V is the same, and in general the respective component parts have been designated by the same letters with an appropriate superscript. The operation for each is the same, and the respective lamp S^2, S^3, S^4, S^5 is lighted to indicate that a station is being received on the respective wave-length band.

The operation of the device may be outlined as follows:—

In assembling and installing the device, the respective potentiometers 34 are adjusted until the resistors Z and X, do not give a response across the solenoid 36 when current from battery 38 is applied across the bridge.

When the operator wishes to determine what stations are transmitting, the switches 11, 20, 39 are moved by means of a common connection 50 into the lower position, so that the antenna 10 is connected through the untuned amplifier arrangement to the ground at 13. The signals from all stations are received and amplified and these signal currents are delivered to the output bus wires 18, 33. These individual oscillatory circuits I, II, III, IV, and V, being tuned to different wave-length bands will respond to the stations transmitting, if any, within their range. By this response, currents are set up in the oscillatory circuits which flow through resistors Z, causing a variation in their temperature and a corresponding change in resistance. This change in resistance of Z unbalances the bridge and current will then flow from battery 38 through the bus wires 40, 41 and the switch 39, to the movable contact 35 of the potentiometer, thence through the respective halves of the potentiometer winding 34 and thus producing a drop of potential across the potentiometer which incites a current through the solenoid 36. This causes the magnetization of the relays 36, 37, 35 to produce the closure of the armature 45 upon its contact 46, and permits current to flow from the secondary 49 of transformer 21 by bus wire 47 to the armature 45, thence to its contact 46, through the indicating lamp S, to bus wire 48 and back to the secondary 49. The lamp is then lighted, and indicates that a station is transmitting somewhere within the wavelength band for which the circuit I is adjusted.

A similar action occurs for any other of the oscillatory circuits, II, III, IV or V, if waves are received at the antenna from stations transmitting within their bands. If a particular lamp lights, the indication denotes that a station is transmitting within the range; and vice versa, if a lamp is dark, no station is indicated.

If for example, the signal lamps, S, S^3 and S^5 are lighted while the signal lamps S^2 and S^4 remain dark, the operator will understand that some stations are sending within the wave length bands of the individual loops I, III and IV. If he then desires to receive a program from a station transmitting within the band III, the switch connection 50 is moved to bring the switch blades to the upper position, whereby the circuit through the battery 38 is opened so that current is no longer applied across the bridge connections of the several groups: and the power supply line for the filaments of the amplifier tubes and

for the indicator lamps themselves is interrupted by the switch blade 20. In this way, the entire indicating apparatus is thrown out of action. On the other hand, the switch blade 11 disconnects the indicating apparatus on its input side, and connects the antenna 10 to the radio receiving set R, which may then be tuned in the ordinary manner and responds to a station within the wave band III; of course, the operator moves within a relatively short range of frequency the setting of the dials of this radio set R, which must be established to receive the station or one of the stations which has caused the brightening of the signal or indicating lamp S^3.

If it is desired to listen to a station in the bands of groups I or V, a similar manipulation of the switches occurs, and the radio set R is tuned within the respective ranges.

It is apparent that many changes may be made in the form of execution of the invention without departing from the scope of the appended claims.

Having thus described my invention, what I claim is:

1. In an indicating device for high frequency currents, an oscillatory circuit tuned to such frequency currents, a device in series in such oscillatory circuit whose resistance varies with the passage of current therethrough, a balancing device and a potentiometer having an intermediate tap, conductor means connecting said devices and potentiometer in a closed series with one another, a source of direct current connected to the intermediate tap of said potentiometer and to the conductor between said devices, an output solenoid connected in shunt of said potentiometer and indicating means controlled by said solenoid.

2. In an indicating device for high frequency currents, a tuned oscillatory circuit, means to connect said oscillatory circuit to a source of high frequency current at times emitting signals of its own tuned frequency, a device in said oscillatory circuit responsive to the passage of currents of such frequency through said oscillatory circuit, a relay having an energizing and an indicating winding, means to energize said energizing winding, means controlled by said device to energize said indicating winding, and an indicating means connected with said relay whereby the passage of such a signal current through said responsive device will cause a change in energization of said relay and produce an operation of said indicating means.

3. In a device for indicating the reception of signals from stations of different frequency, an antenna circuit, a common amplifier and a plurality of tunable oscillatory circuits supplied thereby and individually tuned to separate frequency bands, a respective current responsive resistor in each of said oscillatory circuits, a balancing resistor in each said circuit, a potentiometer in each said circuit, conductor means to connect said resistors and potentiometers respectively in closed series to form Wheatstone bridges of which each arm comprises a resistor and part of the respective potentiometer, a respective relay including a solenoid connected in shunt of each said potentiometer, indicating means controlled by said relay, and means to supply current across the pairs of bridge arms, whereby change of the current through said respective current responsive resistor will produce a change of energization of said relay and indicate the passage of current through the respective oscillatory circuit.

4. In a device for indicating the reception of signals from stations of different frequency, an antenna circuit, an output circuit, an untuned amplifier to receive signals from said antenna circuit and deliver them to said output circuit, a plurality of tuned oscillatory circuits each covering a predetermined portion of the total frequency reception range, and connected across said output circuit, a resistor in series in each of said oscillatory circuits and adapted to be changed in resistance by a current flowing in said oscillatory circuit, and a plurality of indicating means connected to the resistors whereby each indicating means is operated by the change of resistance in its respective resistor.

5. In an indicating device for high frequency currents, a tuned oscillatory circuit, means to connect said oscillatory circuit to a source of high frequency current, a device in said oscillatory circuit responsive to the passage of currents therein of its tuned frequency, a balancing device and a potentiometer connected in series with said device to form a bridge having arms each comprising one of said devices and a portion of the potentiometer, means to supply direct current to the arms of the bridge, a relay having an energizing and an indicating winding, said indicating winding being connected in shunt across said bridge, said energizing winding being supplied with direct current from the aforesaid means, a source of alternating current, an indicating device, and a circuit including the armature of the relay and its contact, said source of alternating current and said indicating device.

6. In an indicating device for high frequency currents, an untuned or aperiodic amplifying device for said currents, and a plurality of individually tuned detector and indicator devices connected in multiple to the output of said amplifying device, each of said detecting and indicating devices including a tuned oscillatory circuit to select from such currents those of a given periodicity band, a resistor thermally responsive by change of resistance to the passage of current therethrough whereby to detect the passage of such currents, a resistor of similar temperature

characteristics, fixed resistances connected to said resistors whereby to form a balanced bridge, means to impose a uni-directional current on the arms of said bridge, and an indicating device connected to the mid-points of said arms.

7. In an indicating device for high frequency currents, a bridge comprising two shunt conductors each containing a fixed resistance and a resistor, said conductors being balanced with respect to each other and said resistances each having one terminal connected by portions of said conductors to a terminal of the other, one of said resistors being thermally responsive by change of resistance to a high frequency current, means to impose a uni-directional current upon both conductors in shunt of each other, indicating means responsive to differences of resistance in said conductors and connected to each conductor at a responsive point intermediate the respective resistance and resistor, and means to impose a high frequency current on said thermally responsive resistor.

8. In an indicating device for high frequency currents, a bridge comprising two shunt conductors each containing a resistance and a resistor, said resistors being adapted to change in resistance in response to change of temperature thereof, said resistances each having one terminal connected by portions of said conductors to a terminal of the other, said conductors being balanced by said resistors with respect to each other so that changes of atmospheric temperature are without effect upon the bridge, means to impose a uni-directional current upon both conductors in shunt of each other, means to impose a high frequency current on one of said thermally responsive resistors whereby to change its temperature and resistance, and an indicating means including a current operated device connected to each of said conductors intermediate the responsive resistance and resistor and responsive to the flow of current produced by the differences of potential at such points resulting from the change of resistance of said one of said resistors.

9. In an indicating device for high frequency currents, a bridge comprising two shunt conductors each containing a fixed resistance and a resistor, said conductors being balanced with respect to each other and said resistances each having one terminal connected by portions of said conductors to a terminal of the other, one of said resistors being thermally responsive by change of resistance to a high frequency current, means to impose a uni-directional current upon both conductors in shunt of each other, means to impose a high frequency current on said thermally responsive resistor, a relay having an exciting coil, indicating means controlled by said relay, and a relay conductor including said coil and connected to each of said conductors intermediate the respective resistance and resistor thereof, whereby the flow of high frequency current will change the resistance of said thermally responsive resistor and thereby provoke the flow of current through said relay conductor and coil and cause the operation of said indicating means.

Signed at New York in the county of New York and State of New York this 14th day of August, A. D. 1925.

KARL G. KARSTEN.