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TUNING INDICATOR FOR RADIORECEIVERS

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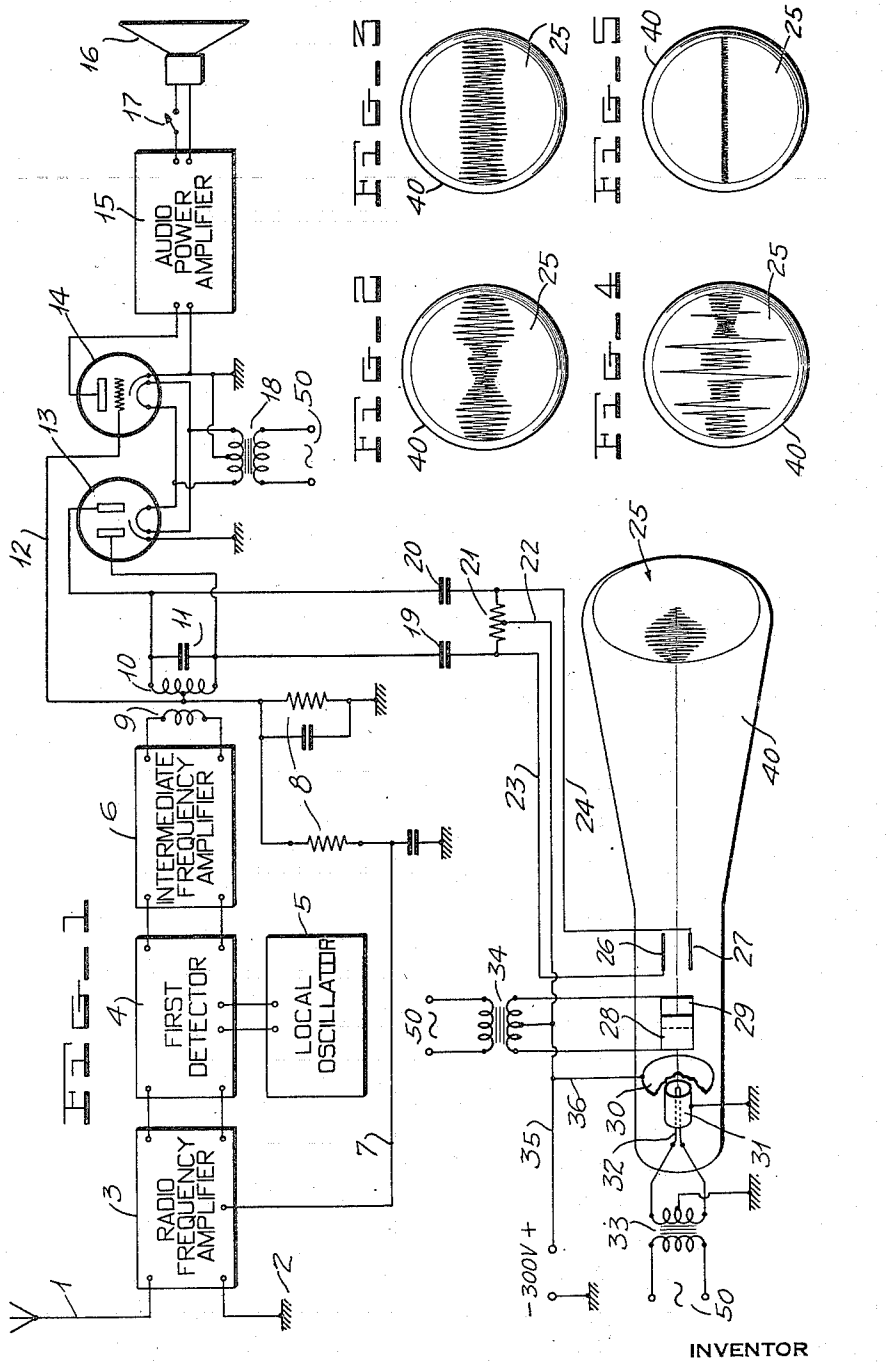

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TUNING INDICATOR FOR RADIORECEIVERS

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2 Claims. (Cl. 250—40)

My invention pertains to devices for receiving electromagnetic waves commonly known as radio receivers, and relates more specifically to the tuning indicators and systems of such devices.

It is common practice in tuning radio receivers to a selected carrier frequency, to rely on the audibility of the signal as received in an audio responsive device such as a loudspeaker to adjust the variable tuning elements to bring in the signal with required clarity and proper tonal values. In modern receivers the tuning systems are so extremely sensitive and selective that a high degree of proficiency and good judgment of tonal value and quality is required to effect optimum tuning. Unless the receiver is tuned to exact resonance with the carrier frequency, portions of the side bands are cut off with resultant introduction of distortion and loss of tonal quality. This difficulty has been appreciated for some time and many efforts have been made recently to overcome the difficulty through employing so-called "shadow" or "silent" resonance indicators in order that the eye of the operator might be used in lieu of the ear to effect optimum tuning. Several types of these silent resonant indicators are now coming into use. They all, however, employ a type of neon or glow tube in which the intensity of the light varies with the condition of tuning, or the light varies in height in a tube to indicate resonance. It is a well recognized fact, which I have verified recently by experiment, that while the eye experiences considerable difficulty in differentiating between variations in intensities of light or variations in the height of a column of light, it very easily and quickly differentiates between variant distinctive luminous designs.

I have discovered by the use of a cathode ray oscillograph introduced into a radio receiving circuit in a novel manner that I am able to produce on the fluorescent screen of the oscillograph distinctive designs which indicate definitely the condition of resonance of a radio receiver in such a clear manner that the ordinary eye can readily perceive the difference between an unmodulated carrier, off resonance, resonance, and the presence of static. Further, I have proved by experiment that an operator of a radio receiver can quickly, by such means, tune a radio receiver to optimum resonance and further distinguish between the ratio of signal volume and static without the use of a loudspeaker or other audioresponsive device.

An object of my invention resides in providing a tuning indicator for radio receivers which will indicate by distinctive luminous design the condition of resonance of the receiver.

Another object contemplated by my invention consists in providing a silent tuning indicator which will indicate through dstinctive variant luminous designs the condition of resonance of the receiver, the presence of static, and the presence of an unmodulated carrier wave.

A still further object of my invention consists in providing a simple and effective visual tuning indicator for radio receivers.

I accomplish all of the above very desirable features and eliminate the above recited undesirable features by providing a cathode ray oscillograph introduced into the circuit of a radio receiver in a novel way and energized from the same source of energy supplying current to the radio receiver.

My novel tuning indicator can of course be utilized with any type of receiver employing alternating current as the primary source of current supply, as will hereinafter be fully explained, but it is especially adapted for use with highly selective receivers of the modern superheterodyne type and I have therefore arbitrarily chosen to illustrate my novel indicator as used with such modern type of receiver.

In the figures accompanying and forming a part of this specification; in which like reference numerals designate corresponding parts throughout;

Fig. 1 illustrates diagrammatically the apparatus and circuit connections for utilizing my tuning indicator in conjunction with a superheterodyne radio receiver;

Fig. 2 illustrates the appearance of the fluorescent screen of the cathode ray oscillograph when the receiver is tuned to resonance;

Fig. 3 illustrates the appearance of the fluorescent screen of the oscillograph when the receiver is not tuned to exact resonance and all side bands are not being received;

Fig. 4 illustrates the appearance of the fluorescent screen of the oscillograph when a modulated carrier accompanied by static is received; and

Fig. 5 illustrates the appearance of the fluorescent screen of the oscillograph when no signal is being received.

Referring now to the drawing and particularly to Fig. 1 which illustrates diagrammatically the circuits and apparatus arrangement for employing my novel indicator in conjunction with a modern superheterodyne receiver, the receiver is of the usual type employing an antenna 1, earth connection 2, radio frequency amplifier 3, first

detector 4 and local oscillator 5, and an intermediate frequency amplifier 6 coupled by means of inductances 9 and 10 with a duo-diode detector 13 which is connected in the usual way to an audio amplifier 14 which is in turn connected through an audio power amplifier 15 to a loud speaker 16 or other audio responsive device. The radio frequency amplifier 3 is connected through conductor 7 to an automatic volume control circuit 8 connected to the grid of the audio amplifier tube 14 by conductor 12 and to the mid-point of secondary 10. This comprises the usual well known organization found in modern superheterodyne receivers and as it forms no essential part of my invention no further explanation is deemed necessary.

In carrying out my invention, I prefer to employ a switch 17 whereby the loudspeaker as a tuning indicator may be disconnected from the audio power amplifier during the tuning interval and substitute a cathode ray oscillograph 40 comprising the usual cathode 32, focussing cylinder 31, perforated anode 30, ray deflecting plates 26, 27, 28 and 29, and fluorescent screen 25. The cathode is energized from a source of alternating current 50 which likewise energizes the cathode heating filaments of all of the tubes as shown with respect to the duo-diode 13 and amplifier 14, the heating filaments of which are supplied from the source 50 through transformer 18. The mid-point of the secondary of transformer 33 supplying current to the cathode 32 of the oscillograph 40 is connected to ground as usual, as is focussing cylinder 31. Ray deflecting plates 28 and 29 are connected through transformer 34 with the cathode heating source of alternating current 50. The mid-point of the secondary of transformer 34 is connected through conductor 35 with the positive terminal of the 300 volt direct current source supplied by the rectifier or "power pack" usually employed with modern radio receivers. The negative terminal of this source of direct current is as usual grounded. The ray deflecting plates 26 and 27 are preferably connected through condensers 19 and 20, respectively, across the secondary 10 of the inductance coupling the intermediate frequency amplifier with the duo-diode detector 13. Tuning condenser 11 is likewise bridged across the secondary 10. The plates 26 and 27 are shunted by a resistance 21, the mid-point of which is connected through conductor 22 with the positive terminal of the 300 volt direct current supply and the anode 30 is connected through conductors 36 and 35 with the positive terminal of the 300 volt supply.

With the organization connected as above described, the cathode ray beam is caused by electrostatic action of plates 28 and 29, influenced by the local alternating current supply 50 to traverse a horizontal path on the fluorescent screen 25 of tube 40. Plates 26 and 27 being connected to the input of the duo-diode detector 13, as hitherto described, cause the cathode ray beam to be deflected at right angles to the deflection produced by plates 28 and 29 to provide the other coordinate motion of the beam to produce distinctive variant luminous designs indicating the condition of the radio receiver with respect to resonance to the wave being received and also the character and condition of the electromagnetic waves and disturbances collected by the antenna 1 and ground 2.

I have found by experiment with the organization just described that the moving designs on the fluorescent screen 25 show low frequencies due to the wave deflecting plates 26 and 27 only when the receiver is tuned to quite perfect resonance with the received wave. The design produced is approximately that shown in Fig. 2. If the tuning system of the receiver is off tune, the low frequencies in the modulated carrier being received lose amplitude remarkably due to the loss of the low frequency side bands and the consequent gain in the high frequency side bands and the appearance of the fluorescent screen in the tube 40 is approximately that shown in Fig. 3.

The modern superheterodyne receiver is so highly selective that when an operator other than an expert attempts to tune such a receiver through the use of the ear alone, the receiver is almost always off tune to one side or the other of the carrier. This results in a loss of the upper or lower side bands and a distortion and loss of true tonal quality in the received signals. The oscillograph, I have found, produces variant distinctive designs which the eye readily and quickly differentiates to assist an operator to tune a radio receiver to the exact resonance necessary to receive high quality signal reproduction. In carrying out my idea I prefer to disconnect the loudspeaker by opening the switch 17 and to manipulate the tuning organization of the receiver, observing at the same time the appearance of the luminous design on the screen 25 of the cathode ray oscillograph and thus by the use of the eye alone set the tuning organization of the receiver at exact resonance with the received wave. When exact resonance is indicated by the distinctive luminous design as shown approximately in Fig. 2, the loudspeaker switch 17 is closed and the quality of reproduction by the loudspeaker is an optimum.

The presence of static can readily be observed by my oscillograph indicator without the disagreeable necessity of listening thereto by the loudspeaker. As shown in Fig. 4, the presence of static with the modulated wave is clearly indicated by peaks accompanying the design showing that the receiver is tuned to resonance with the received wave. Fig. 3 illustrates approximately the appearance of the luminous screen 25 when the receiver is not tuned to exact resonance and portions of the side bands are not being received. This design is, it will be noted, widely variant from the design indicating resonance.

Fig. 5 illustrates approximately the appearance of the luminous screen 25 when an unmodulated carrier is being received or when no signal is being received.

While I have arbitrarily described my novel indicating device as used in connection with a modern superheterodyne receiver, it can also be used in conjunction with other types of receivers. In a tuned radio frequency receiver the deflector plates 26 and 27 may be connected to the input of the detector tube and the oscillograph will function in quite the same manner as that described with respect to a superheterodyne receiver. It is of course obvious that my signal indicator must be used with a receiver which is designed to employ alternating current as the primary energy source.

It will be obvious that the primary alternating current energizing source of the receiver acts through electrostatic action on the ray deflecting plates 28 and 29 to produce a luminous line in one coordinate and that the signal frequencies present in the received electromagnetic wave produce, by electrostatic action through plates 26

and 27, movement of the cathode beam in the other coordinate to produce the two coordinate distinctive variant luminous designs which indicate the character and condition of the electromagnetic wave being received and the condition of resonance of the tuning elements of the receiver with respect to the received wave.

The moving designs on the screen 25 are very attractive and interesting to the observer and the oscillograph may therefore to advantage be maintained connected to the receiving circuit at all times as a feature of added interest to the aural reception of signals.

While I have illustrated and described but one embodiment of my invention, it is to be distinctly understood that I may widely vary the details thereof without departing from the spirit or narrowing the scope of my invention.

Having thus completely described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A visual tuning indicator for radio receivers comprising a radio receiving circuit including thermionic tubes, a cathode ray oscillograph, a source of alternating current for energizing the cathodes of said thermionic tubes and said cathode ray oscillograph, a source of potential for the anodes of said thermionic tubes and said cathode ray oscillograph, connections between said source of potentials, said radio receiving circuit and one of the ray deflecting means of said cathode ray oscillograph and connections between said source of current supply for the cathodes of said thermionic tubes and the remaining ray deflecting means of said oscillograph, whereby said oscillograph is caused to indicate on the fluorescent screen thereof in luminous design the condition of the electromagnetic waves being received by said receiver and the degree of resonance of the receiver with a received wave.

2. A tuning indicator for radio receivers comprising, a superheterodyne receiving circuit including, tuning elements, a first and second detector and a source of energizing alternating current, a source of direct current potentials for said receiver, a cathode ray oscillograph, the cathode and one set of ray deflecting means of which are connected with said source of alternating current and the remaining ray deflecting means of which are connected through condensers in parallel with the input impedance of said second detector whereby said oscillograph is closed to indicate on the fluorescent screen thereof in variant luminous distinctive designs the condition of the electromagnetic waves being received by said receiver and the degree of resonance of said tuning elements with a received wave.

HENRY W. PARKER.