

Aug. 15, 1939.

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2,169,306

SHORT-WAVE RECEIVER

Original Filed June 15, 1935

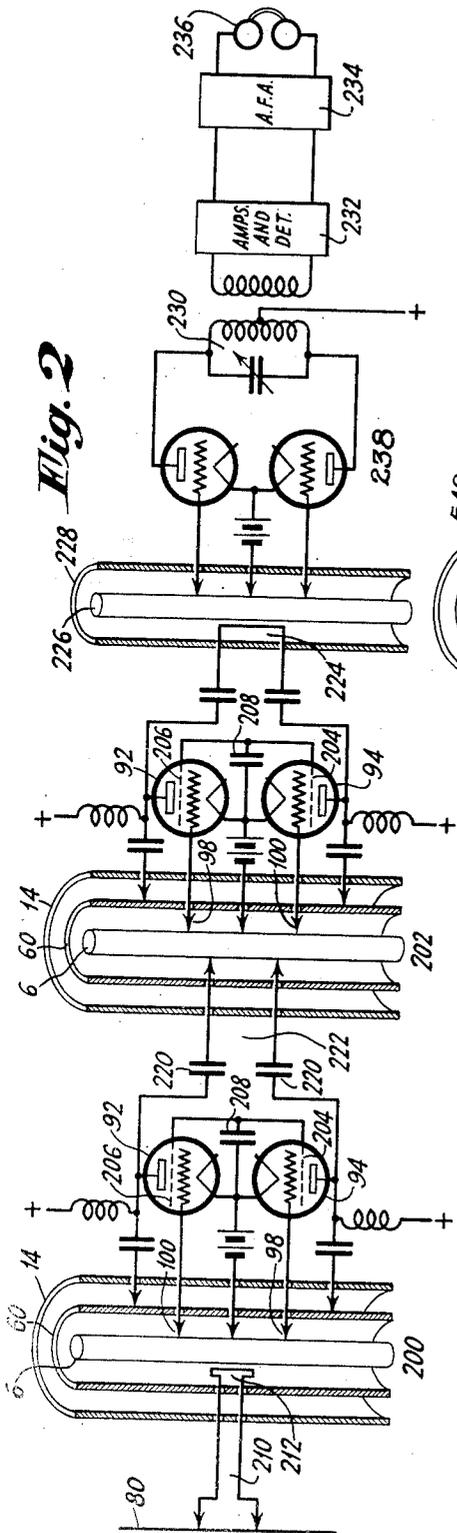


Fig. 2

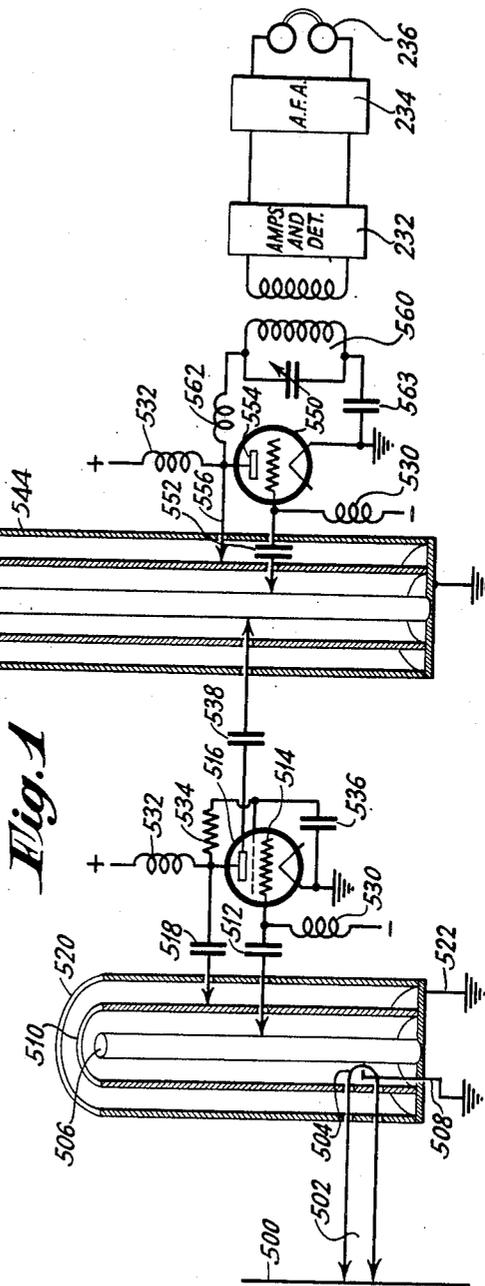


Fig. 1

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# UNITED STATES PATENT OFFICE

2,169,306

## SHORT-WAVE RECEIVER

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Original application June 15, 1935, Serial No. 26,749. Divided and this application March 4, 1937, Serial No. 129,006

5 Claims. (Cl. 179-171)

This application is a division of my copending application Serial No. 26,749, filed June 15, 1935, entitled Low loss circuits.

One object of my present invention is to provide an improved ultra short wave length receiver in which low loss resonant circuits are employed.

In the accompanying drawing, Figures 1 and 2 illustrate preferred forms of my present invention wherein concentric resonant lines or cylinders are utilized in the high frequency and intermediate frequency stages of a short wave receiver. Figures 1 and 2 correspond respectively to Figures 5 and 6 of my copending application.

Referring to Figure 1, short wave length energy picked up upon antenna 500 is fed to transmission line 502 and through loop 504 to the resonant line 506. The loop 504 feeds the energy into the line 506 inductively, the loop being grounded at a voltage nodal point by means of the conductor 508. The receiving energy is resonated on the exterior surface of the resonant line 506 and the interior surface of the concentric cylinder 510, and fed through blocking condenser 512 to grid 514 of the first radio frequency amplifier tube 516. The energy amplified by tube 516 is fed through blocking condenser 518 to the outer surface of the metallic cylinder 510 and resonated there and also on the inner surface of the outer tube 520. The bottoms of all of the tubes 506, 510, 520 are grounded by lead 522.

Grid bias for the tube 516 is obtained through choke coil 530, in turn connected to the negative terminal of a source of direct current potential; plate voltage is obtained through choke coil 532, in turn connected to the positive terminal of a source of direct current potential; and screen grid bias is obtained by means of the voltage drop through resistor 534. The screen grid is maintained at radio frequency ground potential by means of a by-passing condenser 536.

The amplified energy from vacuum tube 516 is fed through blocking condenser 538 to the inner tube 540 of the concentrically arranged tubes 540, 542, 544. These concentric conductors are adjusted to be of such length as to resonate at a desired local oscillator frequency somewhat lower than the incoming frequency so that the beat produced under the control of these concentric tubes is of a desired value. The oscillating first detector electron discharge device 550 has its grid connected through a by-passing condenser 552 to the inner tube 540 and its plate 554 through a lead 556 to the outer surface of

the concentric tube 542. The concentrically arranged conductors 540, 542 and 544 are one-quarter wave length long at the desired local oscillator frequency, the taps on the connections from electron discharge device 550 to the lines 540, 542 being so adjusted as to cause oscillation generation due to interelectrode feed-back of the electron device 550. These locally generated oscillations, together with the oscillations obtained through condenser 538 from electron discharge device 516 combine to form a beat frequency which is resonated in the circuit 560 tuned to the beat and completed to the cathode through the blocking condenser 563. This resonated beat frequency energy is fed to further beat frequency amplifiers and detectors 232, audio frequency amplifier 234, and, finally, to the translating device or utilization means shown in the form of a telephone 236.

If desired, the concentric conductors 540, 542, 544 may be made shorter than the concentric conductors 506, 510 and 520, in which case the local oscillator 550 will provide oscillations higher in frequency locally, than the incoming waves and these, when beat with the incoming waves, will produce the desired beat note or beat frequency energy in the beat frequency circuit 560. In order to keep the locally generated oscillations out of the beat frequency circuit a choke coil 562 is provided.

The system shown in Fig. 2 may be used for amplification purposes. In Fig. 2 the concentric cylinder structures 200, 202 are similar to the structure shown in Fig. 4 of my copending application and consists of concentric cylinders or resonant lines 6, 60, 14, each a one-half wavelength long at the operating frequency. These cylinders may be provided with telescoping members, as shown in Fig. 1a of my copending application, at both their upper and lower ends for frequency adjustment. The vacuum tubes 92, 94 are, however, provided with screen grids 206, 204, which are grounded for radio frequency currents by the action of by-passing condenser 208 which may, if desired, be adjusted so as to series resonate the inductance of the screen grid leads at the operating frequency.

Input energy picked up on antenna 80 is fed through the line 210 and coupling loop 212 to the resonant line 6 of the coaxial cylinder system 200. This energy is resonated in the cylinder 6, adjusted to the desired operating frequency, amplified by the first radio frequency push-pull amplifier stage and resonated in the plate circuit of that stage comprising the outer surface of con-

ductor 60 and the inner surface of 14 of the coaxial cylinder system 200. This resonated, amplified energy is fed through the by-passing condensers 220 and transmission line 222, to the cylinder 6 of the system 202, amplified by the tubes 92, 94 of the second push-pull radio frequency amplifier stage, resonated in the concentric cylinder system for that stage comprising the outer surface of tube 60 and the inner surface of tube 14 of the system 202, and fed through the inductive coupling 224 to the resonant line 226 of a first push-pull detector stage 238. The resonant line 226 and its surrounding cylinder 228 are adjusted in length so as to produce oscillations in the push-pull oscillation generation stage of such a frequency as to beat with oscillations in loop 224 and produce a beat of a much lower radio frequency which may be resonated and picked off in the parallel tuned circuit 230. The energy of circuit 230 is fed into amplifiers and detectors 232 and finally into an audio frequency amplifying stage 234 energizing a suitable translating device such as earphones 236. If desired, the circuit 230 will consist of a concentric cylindrical conductor disposed about 228, in which case the conductor 228 and its outer concentric tube will be made of greater length so as to correspond to a one-half wavelength so as to produce a proper beat frequency. The inner resonant line 226 in that case would consist of a shorter tube of the length indicated corresponding to the frequency of oscillations of the local oscillation stage 228.

Having thus described my invention, what I claim is:

1. A radio receiver comprising concentric low-loss conductor resonant elements, means for applying received energy to an inner element, an amplifier device having an input electrode coupled to said inner element at a point intermediate the ends thereof and at least one of its output electrodes coupled to an element about said inner element also at a point intermediate the ends thereof, said inner element comprising one tuned circuit and said other element comprising another tuned circuit, and means for utilizing the output of said amplifier.

2. A high frequency system including a vacuum tube having an input circuit comprising a pair of

concentric metallic tubular surfaces, each a half wavelength long at a desired operating frequency, and an output circuit comprising another pair of concentric metallic tubular surfaces each a half wavelength long at a desired operating frequency, the surfaces of said input circuit and said output circuit being concentrically arranged to conserve space.

3. A radio receiver comprising concentric low-loss conductor resonant elements, means for applying received energy to an inner element, a pair of amplifier devices having their input electrodes coupled in push-pull relation to points on said inner element which are intermediate the ends thereof, and an output electrode of each device coupled to an element about said inner element, said concentric conductor elements being each one-half the length of the resonant wave, and means coupled to said output electrode for utilizing the output of said amplifier devices.

4. A radio receiver comprising concentric low-loss conductor resonant elements, means for applying received energy to an inner element, an electron discharge device having an input electrode coupled to said inner element at a point intermediate the ends thereof and an output electrode coupled to an element about said inner element also at a point intermediate the ends thereof, said concentric conductor elements being each one-quarter the length of the resonant wave, and means for utilizing the output of said electron discharge device.

5. A radio receiver comprising concentric low-loss conductor resonant elements, means for applying received energy to an inner element, a pair of amplifier devices having their input electrodes coupled in push-pull relation to points on said inner element which are intermediate the ends thereof, and an output electrode of each device coupled to an element about said inner element, said concentric conductor elements being each one-half the length of the resonant wave, and means coupled to said output electrode for utilizing the output of said amplifier devices, said means comprising a similar arrangement of concentric low-loss conductor resonant elements and amplifier devices.

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