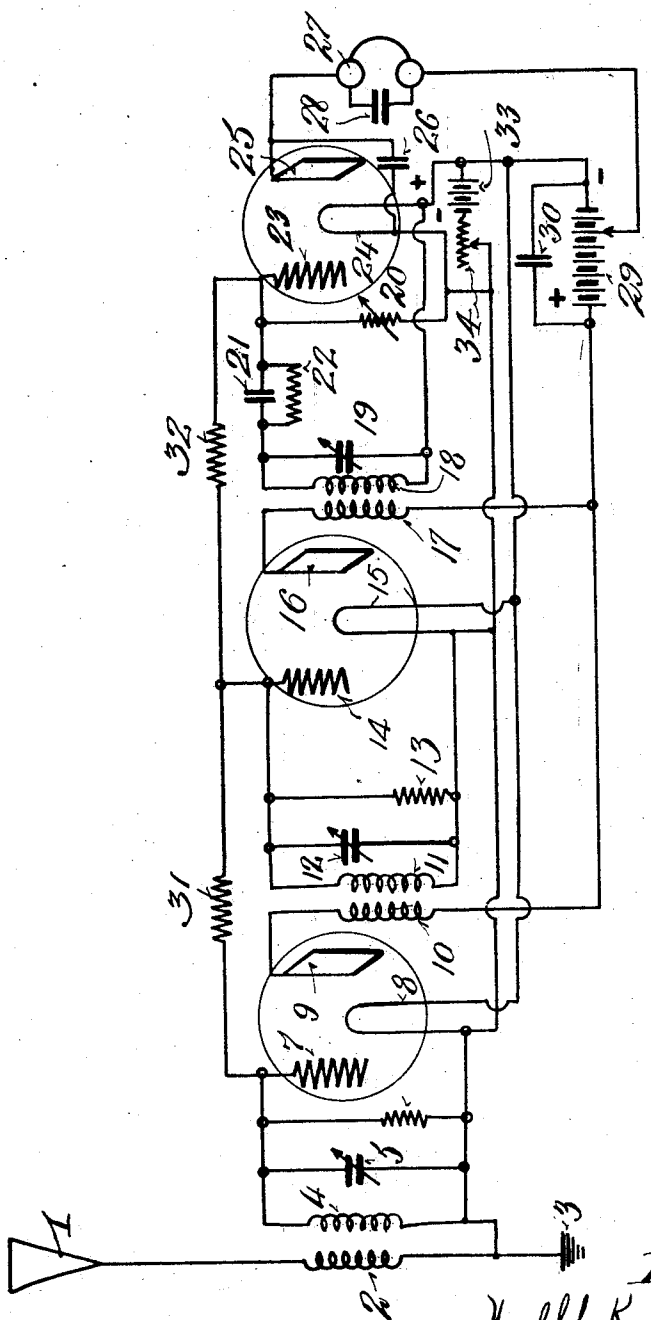
March 22, 1932. W. KAUFMAN 1,850,110

RADIOCIRCUIT

Filed March 5, 1927



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UNITED STATES PATENT OFFICE

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RADIOCIRCUIT

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This invention relates in general to radio receiving circuits.

One of the objects of this invention is the provision of a radio receiving circuit employing three electrode audions characterized by the fact that means are provided for preventing deleterious intercircuit coupling.

A further object of this invention is the provision of means for preventing and suppressing undesirable oscillations due to capacity coupling between the output and input circuits of three electrode audions due to the inherent internal plate to grid capacity.

A further object of this invention is the provision of a series of three electrode audions and their associated circuits connected in cascade to form a radio frequency amplifier and a detector.

A still further object of this invention is to provide resistance connections between the input circuits of each audion of a radio frequency amplifier and a resistance connection between the input or output circuit of the detector tube and the input circuit of the preceding amplifier tube.

These and many other objects are successfully sought by means of the arrangement disclosed hereinafter.

This invention resides substantially in the combination, arrangement, location and circuital connections of the various elements as will be completely described below.

The single figure in the drawing is a diagrammatic illustration of the relative arrangement of the parts to provide my invention.

Since the advent of radio frequency amplifiers employing the well known three electrode audion it has been the aim of those skilled in the art to provide simple and efficient means for preventing intercircuit reaction which is productive of disturbing oscillations. In practical operation a multistage tuned radio frequency amplifier is subject to the production of undesirable oscillations because of the capacity coupling between the input and output circuits of each stage through the inherent capacity between the plate and grid of the audion tubes generally employed in such circuits. I have devised a relatively simple circuit for preventing or suppressing the production of undesirable currents in the input circuit of each stage of the radio frequency amplifier by reason of the reaction of the output current upon the input circuit.

Referring to the drawing, the antenna ground system is shown comprising the overhead network 1, the primary of a transformer 2, and the ground at 3. The secondary of the transformer is shown at 4 and has one terminal connected to the grid 7 of the first audion and has its other terminal connected both to the ground lead and to the filament 8 of the first audion. A variable condenser 5 is shunted across the inductance 4 for the purpose of tuning the grid-filament circuit of the first audion to the frequency of the incoming wave. A high resistance 6 is connected between the grid and filament and provides a leakage path therebetween. I have found that a leak of three megohms is suitable for this purpose. The plate 9 is connected through the primary of a radio frequency transformer 10 which has one terminal connected to the positive side of the B battery source 29, the secondary 11 being shunted by the condenser 12 and comprising the tuned input circuit of the second audion. One terminal of this tuned input circuit is connected to the grid 14 and its other terminal is connected to the filament 15. A high resistance grid leak 13 is connected between the grid and filament and may have a value of the order of two megohms. The plate 16 in the second audion is connected through the primary 17 of a radio frequency transformer which has its other terminal connected to the positive plate battery lead. The secondary 18 of this transformer with its tuning condenser 19 is connected to the grid 23 of a detector tube and one terminal of the filament 24. A grid condenser 21 and grid leak 22 of the usual construction is shown in the grid lead. A high variable resistance 20 which may be adjusted between the limits of ¼ to 10 megohms is shunted between the grid 23 and the filament 24. The plate 25 of the detector tube is connected to the sound reproducing device which has its other terminal

adjustably connected to the B battery 29 to provide any desired value of voltage in this circuit. A fixed condenser 26 is connected between the plate and filament of the detector tube and may have a value of approximately .015 micro-farads and a fixed condenser of a value of .002 micro-farads is shunted across the sound reproducing device 27. The terminals of all the cathodes or filaments are connected in parallel through the variable resistance 34 to a suitable source of supply 33. The grids of the first and second audions are connected together through a resistance 31 of the order of five megohms and the grid of the second audion or radio frequency amplifier is connected to the grid of the detector tube through a resistance 32 of the order of two megohms. A condenser 30 of the value of approximately two microfarads is shunted across the plate battery to provide a by-pass for the audio frequency currents.

I have found that when the elements of a radio frequency amplifier are connected together, as described above, and the condensers and resistances have a value of the order disclosed above that a circuit is provided which is very quiet in operation and which is not subject to set noises due to the generation of undesired oscillations.

It is at once apparent to those skilled in the art that many changes in the details of arrangement of the parts will readily occur without departing from the scope of this invention. For example, while I have disclosed the invention as applied to a 2-stage radio frequency amplifier and a detector it is, of course, true that the principles of the invention may be applied to amplifiers of any number of stages. While I have shown no audio-frequency stages connected to the radio-frequency amplifiers and detector it is clearly evident that instead of connecting a sound reproducing device in the output circuit of the detector tube that the output terminals could be connected to the input of a multi-stage audio-frequency amplifier. It will be further evident that the various values of resistance and capacity which I have disclosed as desirable can be varied to suit particular conditions without departing from the spirit and scope of this invention. I also contemplate within the scope of this disclosure to include a connection between the grid of the last radio frequency amplifier and the plate of the detector rather than the grid of the detector if this is found desirable since I have discovered that fairly satisfactory operation is secured thereby.

I do not, therefore, desire to be particularly restricted to the disclosure in the drawing and specification which have been given for the purposes of illustration, but rather to the field of my invention as I define it in the appended claims.

What I seek to secure by United States Letters Patent is:

1. In a radio receiving system the combination with a plurality of three electrode audions each including a grid, a plate and filament, an input circuit for each audion including grid and filament and an output circuit for each audion including plate and filament, of a series connection between each grid including resistances only.

2. In a radio signalling system the combination with a plurality of three electrode audions each having a grid, plate and filament and their associated circuits arranged to provide a cascade amplifier of a connection between each set of electrically adjacent grids including a high resistance only whereby all the grids are in series.

3. In a radio signalling system the combination with a plurality of three electrode audions each having a grid, plate and filament and their associated circuits arranged to provide a cascade connected multi-stage amplifier and a detector, of a resistance connection between each electrically adjacent grid and a resistance connected between the grid of the last amplifier and the grid of the detector tube all of said grids being electrically in series.

4. In a multi-stage audion receiving circuit comprising a plurality of radio frequency amplifiers and a detector of a resistance connection between the grid and filament of each audion and a resistance connection between the grids of all the amplifiers and between the grid of the last radio frequency amplifier and the grid of the detector.

5. In a radio circuit the combination with an audion amplifier stage and an audion detector, said audions having three electrodes, and circuits associating said audions into an operative circuit of a series connection including resistances only between the grids of said audions.

6. In a radio circuit the combination with an audion amplifier stage and an audion detector, said audions having three electrodes, and circuits associating said audions into an operative circuit of an impedance connection between the grid of the amplifier audion and the grid of the detector audion, and a variable resistance connected between the grid and filament of said detector.

7. In a radio circuit the combination with an audion amplifier stage and an audion detector, said audions having three electrodes, and circuits associating said audions into an operative circuit of a connection including a resistance between the grids of said audions, and a variable resistance connected between the grid and filament of said detector.

8. In a radio receiving circuit the combination with a plurality of audions each having a plate, grid and filament, said audions being connected to form a multi-stage amplifier

and a detector of an impedance connection between the grids of the amplifiers and the grid of the detector, and an adjustable resistance connected between the grid and filament of the detector audion.

In testimony whereof I have hereunto set my hand on this 28th day of February, A. D. 1927.

WOLFF KAUFMAN.