

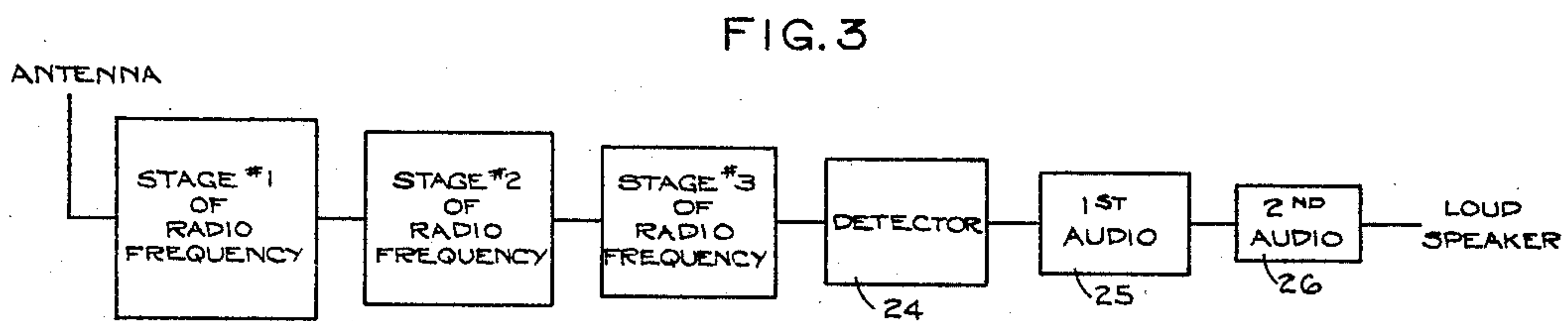
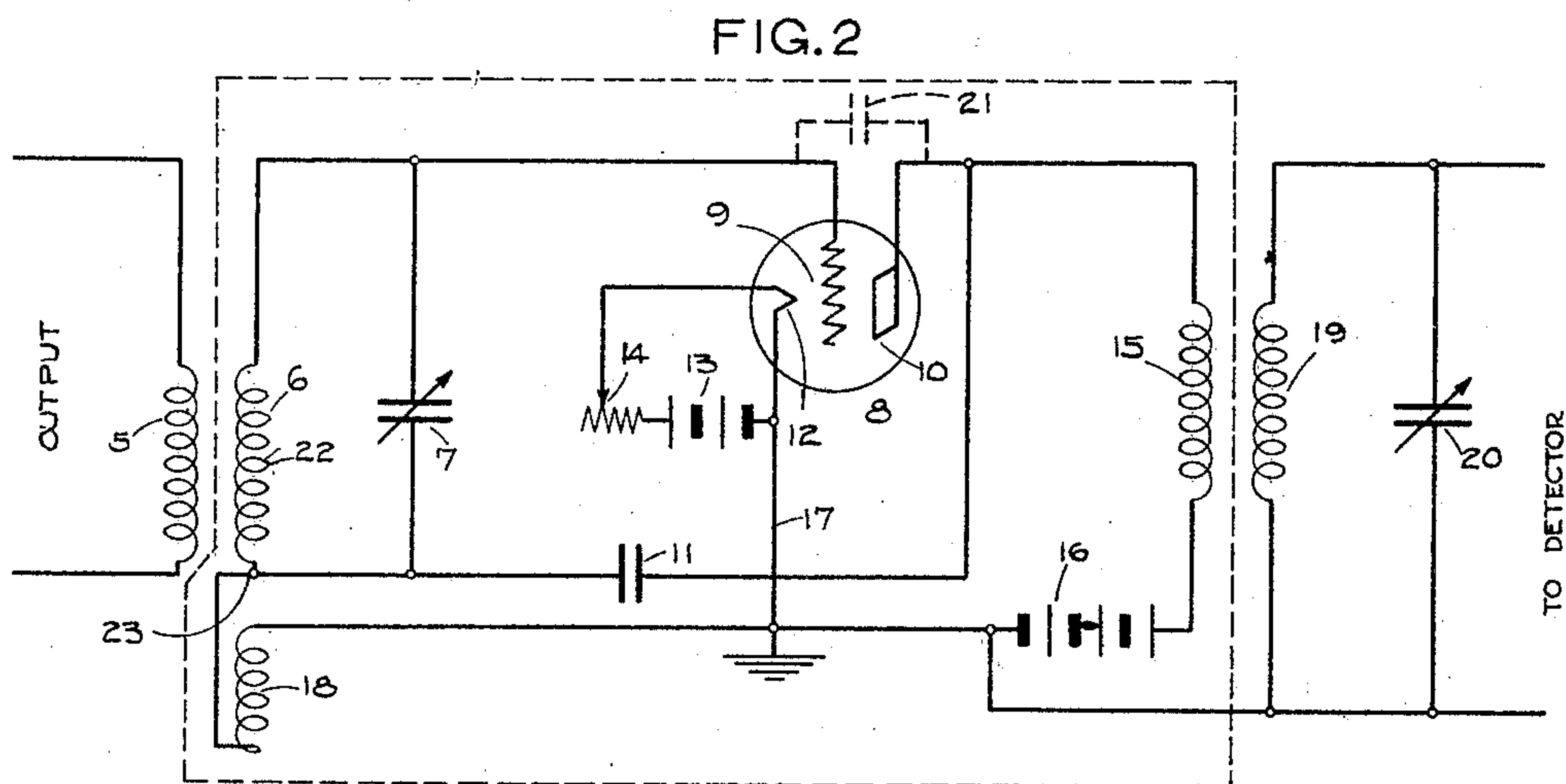
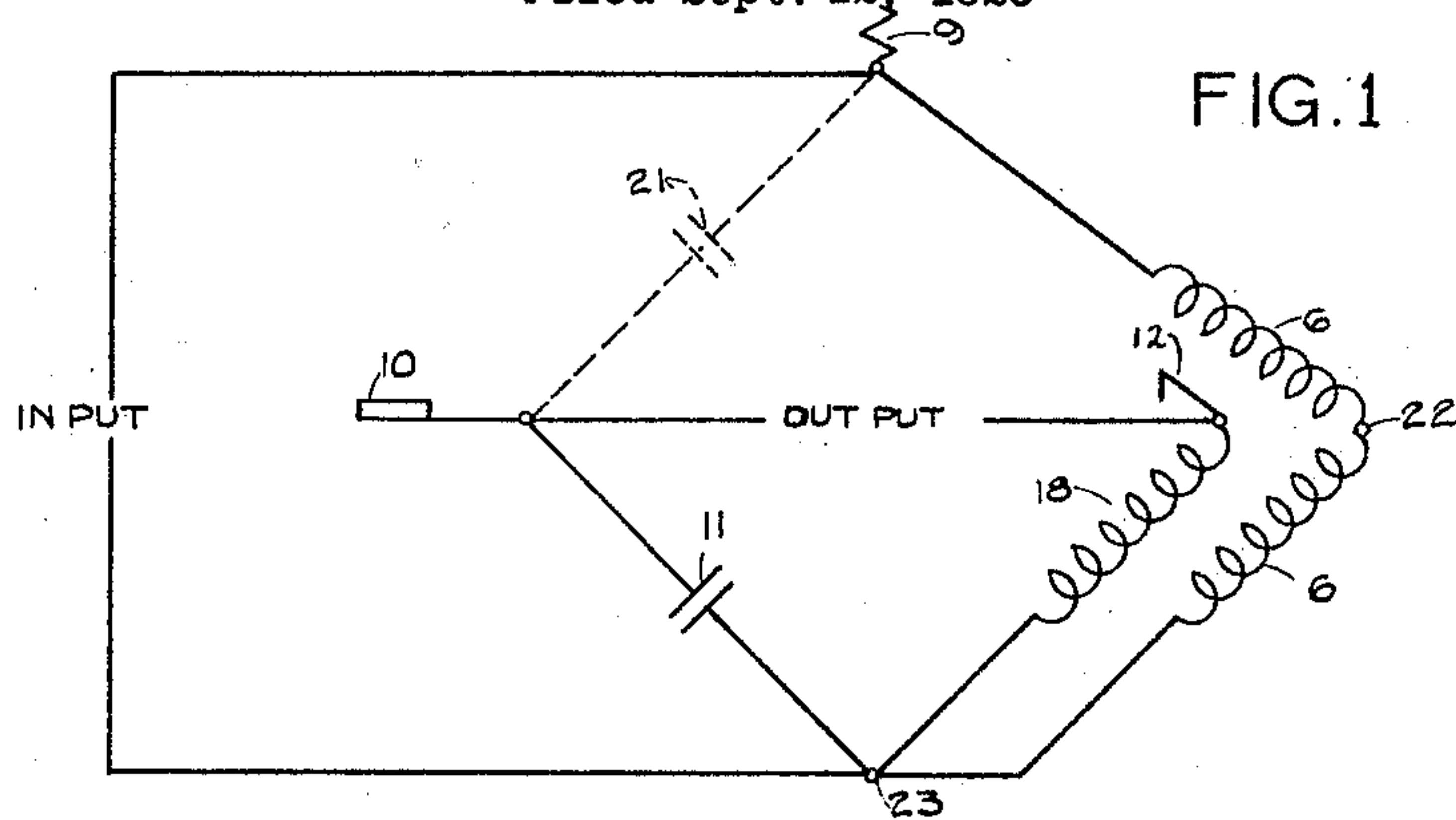
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RADIO SIGNALING SYSTEM

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UNITED STATES PATENT OFFICE.

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RADIO SIGNALING SYSTEM.

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This invention relates to signaling systems and more particularly to amplifying arrangements for use in such systems.

In multi-stage, radio-frequency amplifying systems using a thermionic tube and associated circuits in each stage, great difficulty has been experienced in eliminating undesirable oscillations, resulting in audible noises, which disturb or drown out the signal to be received. These oscillations, for the most part, are due to the phenomenon known as "feed-back", wherein energy from the output circuit of a thermionic tube is returned to the input circuit thereof, through the inherent grid-plate capacity of the tube, causing at certain frequencies increased exaggerated amplification, limited only by the constants of the circuits and the characteristics of the tube.

The object of the present invention is to provide an improved method of eliminating the effect of capacity coupling between the input and output circuits of each stage of a radio-frequency amplifier.

The novel features characteristic of the present invention will appear from the detailed description and appended claims.

For an understanding of the invention, reference is made to the drawings, in which Fig. 1 is a diagrammatic circuit arrangement in the form of an impedance bridge representing one stage of a multi-stage radio-frequency amplifier.

Fig. 2 is a portion of an amplifying system in which the part within the dotted rectangle shows the circuits which are diagrammatically represented in Fig. 1. At the left of the rectangle there is indicated the output circuit of a vacuum tube in a preceding stage, or it may be an antenna or other signal interceptor. At the right of the rectangle there is indicated the tuned portion of an input circuit of a detector (not shown).

Fig. 3 is a diagrammatic showing of a multi-stage radio receiving system, having three stages of radio-frequency amplification, a detector and two stages of audio amplification.

Referring especially to Fig. 2, 5 designates the primary winding of a transformer included in the output circuit of a thermionic radio-frequency amplifier. The secondary winding 6 of this transformer has connected across its terminals a variable condenser 7,

which with the inductance of the winding 7 serves to variably tune the input circuit of the thermionic tube, generally designated 8. The grid 9 of this tube is connected to a point on the circuit connecting the terminals of the secondary winding 6 and the condenser 7, while the plate 10 of the thermionic tube 8 is connected through a compensating fixed condenser 11 to a point on the circuit connecting the other two terminals of the condenser 7 and the secondary winding 6. As is well known the filament 12 has a heating circuit including a source of heating current 13, controlled by a rheostat 14. The output circuit of the thermionic tube 10 extends from the plate 10 through the primary winding 15 of a second transformer, plate battery 16, and conductor 17 to one side of the filament heating system. A coil 18 wound in the same direction as the winding 16, is closely coupled to and has one of its terminals connected to the lower terminal of the winding 6, whereas the other terminal of this coil is connected to conductor 17. The secondary winding 19 of a second transformer couples the output circuit of the thermionic tube 8 to the input circuit of a detector, which is tuned by the variable condenser 20. This detector may be of any well known type, preferably a thermionic detector.

The circuits just described form an impedance bridge arrangement, in which the input circuit is coupled across two sets of arms of the bridge, while the output circuit is coupled across a set of two other arms of the bridge. Although the output circuit is not conductively connected to point 22 on coil 6, the coil 18 inductively connects the output circuit to this point, so that by varying the coupling of coil 18 with respect to the winding 6, the position of point 22 may be varied. By this bridge arrangement electrical energy in the output circuit of a thermionic tube has no effect on the input circuit thereof. As shown in Fig. 1, one of the arms of the bridge includes the inherent capacity 21 existing between the grid 9 and the plate 10 of the thermionic tube. Another arm of the bridge includes the capacity of the fixed condenser 11, which compensates for the inherent capacity 21, while each of the other branches of the bridge includes a portion of the winding 6 as indicated diagrammatically by the portion of the winding extending

from the point designated 22 to each terminal of the winding. In determining the constants of the circuit of Fig. 2, the various elements are so selected that the product of
 5 the reactance of the condenser 11 and the reactance of the upper portion of the coil 6 is equal to the reactance of the lower portion of the coil 6, and the reactance effect of the inherent grid-plate electrode capacity 21.
 10 Under these conditions of balance in the bridge, any electrical condition existing between the plate 10 and the point on the coil 18, associated with the point 22 will have no effect on the input circuit, since the point 23
 15 and the point on the bridge connected to the grid 9 are of the same potential as far as the currents in the output circuit are concerned. However, when an incoming signal current is present in the input circuit of the bridge,
 20 a difference of potential is set up between the filament 12 and the grid 8, which results in causing the thermionic tube 8 to amplify the signal in the well known manner.

The schematic showing of Fig. 3 indicates a tuned radio-frequency amplifying radio receiving system, in which each of the radio-frequency amplifying stages #1 to #3 inclusive, may be of the arrangement shown within the dotted rectangle of Fig. 2.
 30 The detector 24 may be of any well known form and has associated therewith audio-frequency amplifiers 25 and 26 by which the rectified signal is amplified for reproduction in a loud speaker or other indicating device.

35 What I claim is:

1. In an amplifier, an electron discharge device having grid, filament and plate electrodes, a tuned input circuit having included therein a secondary winding of a coupling
 40 transformer and a variable condenser, said input circuit being connected at one end to said grid and being connected at its other end to said filament through a coil closely coupled to said secondary winding, a compensating condenser connected to said plate
 45 and to a point on the conductor extending between said coil and said winding, and an output circuit connected to said plate and said filament.

50 2. In a signaling system, an electron discharge device provided with filament, grid

and plate electrodes having inherent capacity existing therebetween, an input circuit and an output circuit for said device, a transformer having a secondary winding included
 55 in said input circuit, said electron discharge device and secondary winding being connected in an impedance bridge, the inherent capacity between said grid and plate being included in one of the arms of said bridge,
 60 a compensating capacity connected in another arm of said bridge, portions of said secondary winding being connected as the other two arms of said bridge, terminals of said input circuit being connected to con-
 65 jugate points on said bridge, an output circuit conductively connected at one of its ends and inductively connected at its other end to another pair of conjugate points on said
 70 bridge, said output circuit conductively extending from said plate to said filament and being connected through a coil coupled to one portion of said secondary winding and thence to a point on said bridge between said
 75 compensating condenser and one terminal of said secondary winding.

3. In an amplifier, an electron discharge tube having filament, plate and grid electrodes with inherent capacity existing there-
 80 between, an impedance bridge connecting said electrodes, the inherent capacity between the grid and the plate electrodes forming one arm of said bridge, a compensating condenser connected between said plate electrode and a common point on said bridge forming a
 85 second arm of said bridge, a secondary winding of a transformer being connected between the grid and said common point to form the other two arms of said bridge, an input circuit for said discharge tube including said
 90 secondary winding connecting said grid and filament, an output circuit connecting said plate and filament, and a coil in series with a conductor extending from said common point to said filament, said coil being induc-
 95 tively connected to an intermediate point on said secondary winding.

In witness whereof, I hereunto subscribe my name this 10th day of September A. D. 1925.

WINFRED T. POWELL.