

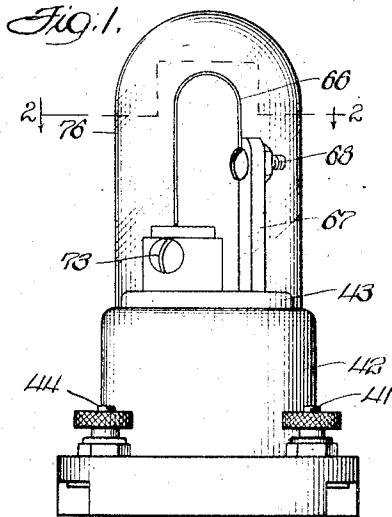
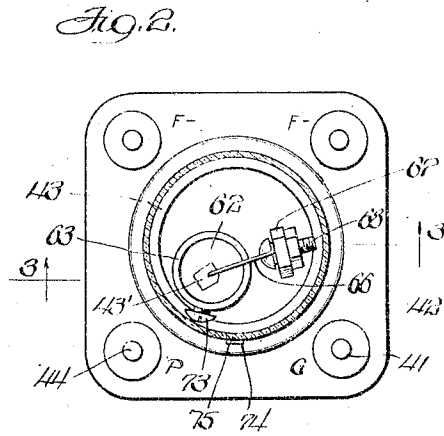
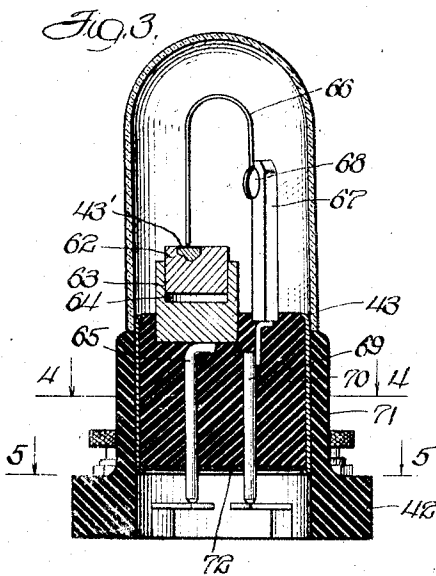
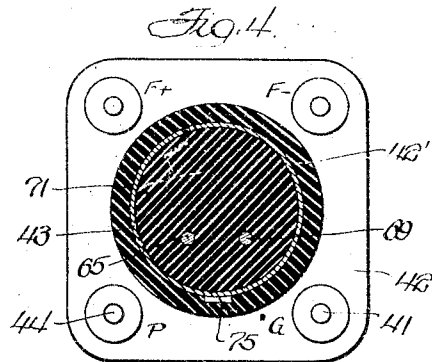
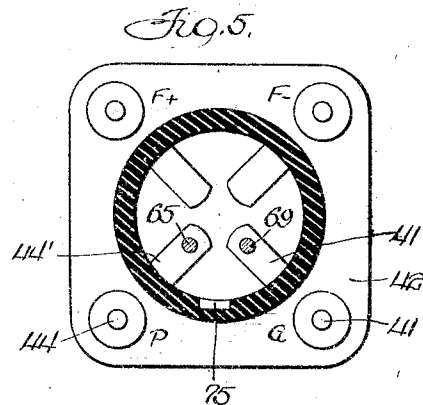
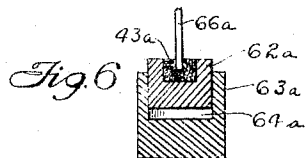
May 12, 1925.

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W. LYTTON
RADIO RECEIVING DEVICE

Filed Feb. 13, 1923

2 Sheets-Sheet 1



Witnesses:

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May 12, 1925.

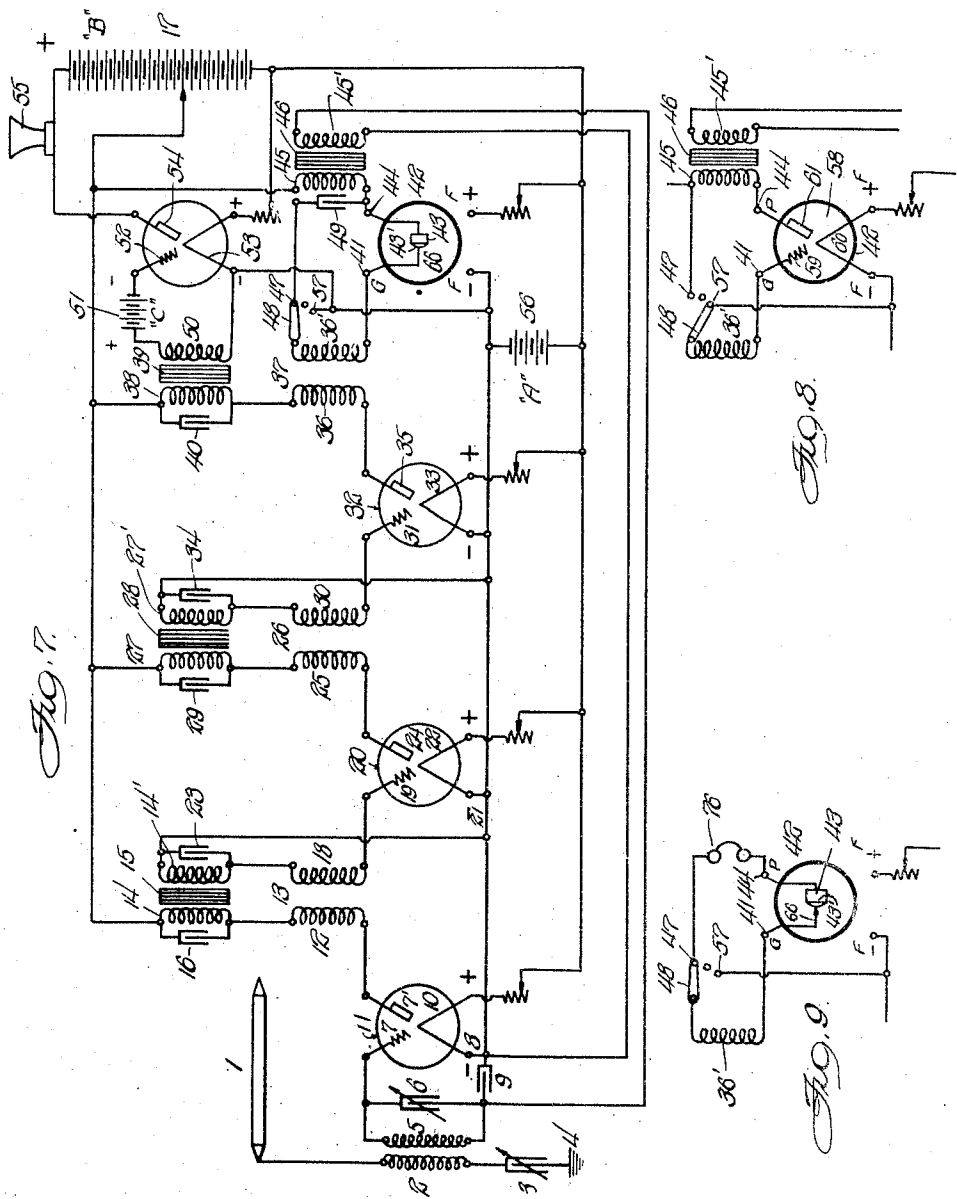
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W. LYTTON

RADIO RECEIVING DEVICE

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2 Sheets-Sheet 2



Witnesses:

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UNITED STATES PATENT OFFICE.

WALTER LYTTON, OF CHICAGO, ILLINOIS, ASSIGNOR TO LYTTON INCORPORATED, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

RADIO RECEIVING DEVICE.

Application filed February 13, 1923. Serial No. 618,799.

To all whom it may concern:

Be it known that I, WALTER LYTTON, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Radio Receiving Devices, of which the following is a specification.

This invention relates to means for receiving radio signals, and more especially to the amplification and detection of radiofrequency signals by vacuum tubes and a crystal detector, and further to the amplification of the detected signals by the same tubes.

The main objects of this invention are to provide an improved construction and arrangement of radio apparatus adapted for flexibility in use, and especially to facilitate changing from crystal detector to three element vacuum tube equipment and vice versa; to provide an improved form of crystal mounting adapted to fit in an ordinary three element tube socket; to provide an improved circuit arrangement including a switching device adapted to accommodate the use of either my special crystal holder (hereinafter described), or an ordinary three element tube.

An illustrative embodiment of this invention is shown by the accompanying drawings, in which—

Figure 1 is a front elevation of a crystal detector unit mounted in a socket adapted to receive three element vacuum tubes and crystal units such as herein referred to interchangeably.

Fig. 2 is a plan of the device shown in Fig. 1, with the glass dome in section on the line 2—2 of Fig. 1.

Fig. 3 is a vertical axial section on the line 3—3 of Fig. 2.

Fig. 4 is a horizontal section on the line 4—4 of Fig. 3.

Fig. 5 is a section on the line 5—5 of Fig. 3.

Fig. 6 shows a modified form of detector adapted for use in place of, or interchangeably with the member 62 of Figure 3, the view being in section similar to the corresponding part of Fig. 3.

Fig. 7 is a conventional circuit diagram showing an interchangeable crystal detector unit in place, and with the switch set accordingly.

Fig. 8 shows that part of the circuit of

Fig. 7 which includes the interchangeable unit and change over switch, a three element tube being here shown in place.

Fig. 9 also shows the same part of the circuit as Fig. 8, but a head-phone is here connected in place of the inductance primary 45, the condenser being omitted.

Referring now to the drawings, Fig. 7 shows the circuit connections of my "duplex" radio receiving system. In this diagram the antenna 1 is connected in series with the inductance primary 2 and the variable condenser 3 to the ground 4. The inductance 2 transfers the radiofrequency energy to the inductance secondary 5 which is tuned by the variable condenser 6. This combination is connected to the grid 7 and to the negative side 8 of the adjacent filament through a small stopping condenser 9. Grid 7 controls the flow of electrons between the hot filament 10 and the plate 7' of the vacuum tube 11. The plate 7' is connected to the primary 12 of the radiofrequency transformer 13. The other side of primary 12 is connected to the primary 14 of the audiofrequency transformer 15. Primary 14 is shunted by a small condenser 16 to allow the radiofrequency energy from the high-voltage "B" battery 17 to pass the primary winding 14. The radiofrequency transformer 13 transfers the radiofrequency energy from primary 12 to secondary 18 which in turn impresses it on grid 19 of tube 20. The other side of secondary 18 is connected to the negative terminal 21 of the filament 22 of tube 20 through a small fixed condenser 23. This grid 19 controls the flow of electrons between the filament 22 and the plate 24 of vacuum tube 20. The plate 24 is connected to the primary 25 of the radiofrequency transformer 26. The other side of the primary winding 25 is connected to the primary 27 of the audiofrequency transformer 28. This primary 27 is shunted by a small fixed condenser 29 so as to allow the radiofrequency energy to come from the "B" battery 17 and pass said winding 27 of transformer 28 and through the primary winding 25 of radio transformer 26 to the plate 24. The radiofrequency energy in the primary 25 is inductively transferred to secondary 30 of radiofrequency transformer 26. One side of secondary winding 30 is connected to grid 31 of the third vacuum tube 32. The other side of primary wind-

ing 30 is connected to the negative terminal of filament 33 through the small condenser 34. The grid 31 controls the flow of electrons from the incandescent filament 33 to plate 35 which is connected to the primary 36 of the last radiofrequency transformer 37. The other side of primary 36 is connected to the primary 38 of the audiofrequency transformer 39. The primary winding 38 is shunted by a small fixed condenser 40 which will allow the "B" battery 17 to transfer vibrant energy past primary 38 to the primary 36 of the radiofrequency transformer 37 and thence to plate 35 of tube 32. The radiofrequency energy is transferred from primary winding 36 of radiofrequency transformer 37 to the secondary 36'. The secondary 36' is connected to the "grid" terminal 41 of the vacuum tube socket 42. Mounted in this vacuum tube socket 42 is a special crystal detector unit 43. This unit electrically connects the grid terminal 41 through the crystal 43' of said unit to the "plate" terminal 44. This terminal 44 is connected to the primary 45 of the audiofrequency transformer 46. The other terminal of primary winding 45 is connected to the point 47 of the three-point switch 48. The hinge-post of said switch is connected to the secondary 36' of the radiofrequency transformer 37.

Condenser 49 is connected across the primary winding 45 of the radiofrequency transformer 46 to increase the capacity of the primary winding 45 and to allow the radiofrequency to pass.

The crystal detector 43' rectifies the radiofrequency energy from the secondary winding 36' and thus impresses on the transformer 46 an audiofrequency signal. This signal is transferred from primary 45 to secondary 45'. This secondary 45' is connected across the small stopping condenser 9 which, as above explained, is connected between the filament of tube 11 and the secondary winding 5. This serves to connect an audiofrequency signal between the negative side 8 of filament 10 and the grid 7. This audiofrequency signal will operate tube 11 and an audiofrequency current from the "B" battery 17 will flow through the primary 14 of the audiofrequency transformer 15 and the primary 12 of radiofrequency transformer 13 to plate 7' of tube 11, thus operating the audiofrequency transformer 15 and transferring the audiofrequency signal in primary 14 to secondary 14'. This secondary 14' is connected in series with secondary 18 of the radiofrequency transformer 13, so we impress the audiofrequency signal on grid 19 of tube 20. Similarly the audiofrequency signal from primary 27 is carried inductively to secondary 27' and thence through secondary 30 is impressed on grid 31 of tube 32. This in turn allows the au-

diofrequency current to flow from "B" battery 17 through the primary 38 of the audiofrequency transformer 39 to plate 35 of tube 32. The audiofrequency signal is transferred from primary 38 of audiofrequency transformer 39 to the secondary 50 which is connected in series with a biasing "C" battery 51 across the grid 52 and the negative side of filament 53 of the power tube 54. The audiofrequency signal on grid 52 controls the output of the "B" battery 17 through the loud speaker 55. The power tube 54 is only used for audiofrequency.

The filaments 10, 22, 33, and 53 of the vacuum tubes 11, 20, 32 and 52 are connected in parallel with one another across the "A" storage battery 56. In case the crystal detector unit 43 is not to be used it can be easily removed from socket 42 and a three element amplifying tube 58 inserted in its place, as in Fig. 8. In order that this amplifying tube 58 may operate properly the switch blade 48 will have to be swung from contact point 47 to contact point 57.

The operation of vacuum tube 58 is as follows: The secondary 36' of the radiofrequency transformer 37 is connected between the grid 59 and the negative side of filament 60. The variation in the voltage of this grid 59 will control the flow of current between the plate 61 and the filament 60. This plate current comes from the "B" battery 17 through the primary winding 45 of the audiofrequency transformer 46. The operation of the set from this point is as described above.

Referring to the structure of the crystal unit 43 and its socket 42 in which it fits interchangeably, the crystal 43' is set in a casting 62 of cylindrical shape which is secured in a cup-shaped block 63, being locked in the recess 64. Secured to the underside of block 63, as by means of solder, is a terminal rod 65.

The feeler wire 66 is held in adjustable relation to the crystal 43' by means of a post 67 to which it is secured by a screw 68, and a terminal 69 is connected to the lower end of post 67.

The block 63, post 67 and terminals 68 and 69 are all held in place by a hard setting material or wax 70 contained in a cylindrical casing 71, the bottom of which is closed by a fiber wall 72. The block 62 is secured interchangeably by set-screw 73.

When the unit 43 is in place the terminals 65 and 69 bear downwardly upon the spring contacts 44' and 41' respectively. The unit is held in place by a projecting shoulder 74 fitting in the vertical slot 75 in the cylindrical upstanding wall 42' of the base 42. Said base is made of insulating material.

Referring to Figure 6, the detector element here shown is similar in construction to that shown in Fig. 3 except that in place

of a crystal 43^a a quantity of loosely assembled particles 43^a is provided in the cup 62^a, which is similar in exterior form to the block 62 and corresponds thereto. Said block 62^a fits in the chamber 64^a of the supporting member 63^a, similar in character to the chamber 64 and the support 63 respectively of Fig. 3. In this instance the wire 66^a extends into the loose particles instead of being merely in contact with the surface of the crystal as represented by the wire 66 of Fig. 3.

In case it should be desired to use a head phone in this system in place of the loud speaker 55, a phone device 76 may be connected in the circuit as shown in Fig. 9. Here the head phone takes the place of the inductance primary 45, and the condenser 49 is omitted.

It may be noted that while I prefer to use a condenser 49 in connection with the member 45 it is not necessary and may be omitted, as in Fig. 8.

Although but one specific embodiment of this invention is herein shown and described, it is to be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of the invention as defined by the following claim.

I claim:

In a radio receiving system, the combination of a four terminal socket adapted to receive either an ordinary vacuum tube or a crystal detector interchangeably, a radio frequency transformer, an audiofrequency transformer, and a switch arranged to connect one side of the radiofrequency secondary to one side of the audiofrequency primary, and the opposite sides of said secondary and primary being connected to appropriate terminals of said socket respectively.

Signed at Chicago this 3rd day of February 1923.

WALTER LYTTON.