

Feb. 20, 1934.

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1,947,660

RADIO RECEIVING APPARATUS

Filed Aug. 6, 1931

2 Sheets-Sheet 1

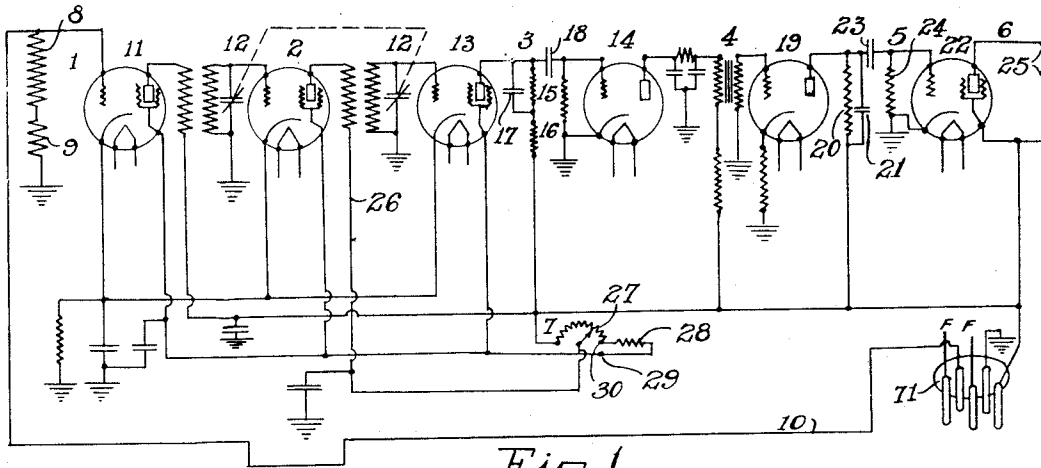


Fig. 1.

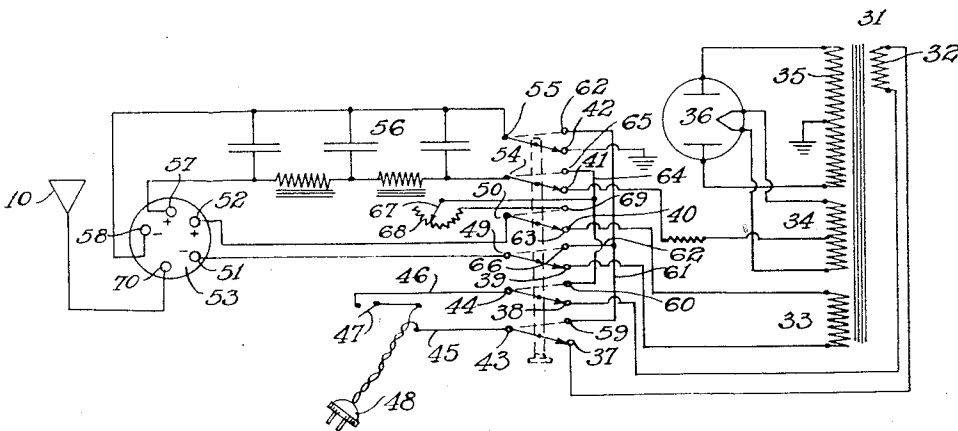


Fig. 2.

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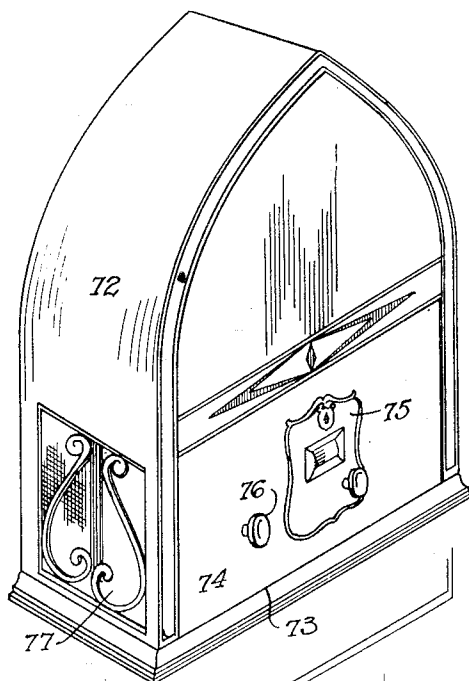


Fig. 3.

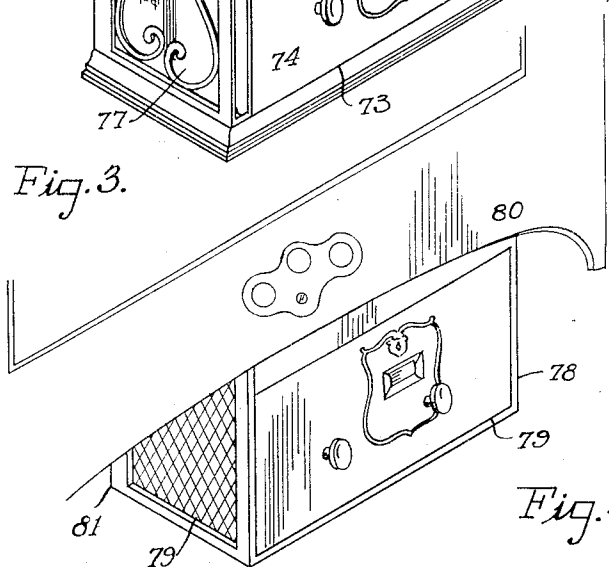


Fig. 4.

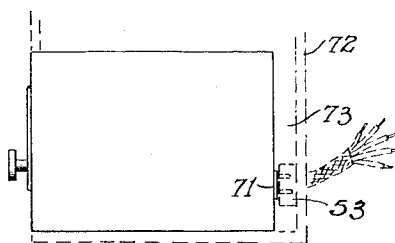


Fig. 5.

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UNITED STATES PATENT OFFICE

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RADIO RECEIVING APPARATUS

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Application August 6, 1931. Serial No. 555,593

1 Claim. (Cl. 250-27)

This invention relates to new and useful improvements in radio receiving apparatus.

The principal object of my invention is to provide a circuit and an arrangement of radio receiving apparatus which permits its successful operation on either alternating or direct current from the usual house lighting circuit or from batteries.

Another object of my invention is to provide a circuit involving a new untuned antenna circuit, an improved untuned aperiodic detector circuit and a pentode tube circuit in the last stage.

It is still another object of my invention to provide new and novel means for utilizing a single power pack, operable on either alternating or direct current from the usual house lighting circuit to produce a filament current and a direct current plate supply of the proper value.

Another object of my invention is to provide a radio receiving apparatus that may be used in an automobile or other vehicle with batteries as a source of filament and plate current and later removed to the home for use on either alternating or direct current from the house lighting mains without changing the radio receiving apparatus.

My invention may be divided into three elements, each of which has outstanding merit and in the following specification each will be treated separately.

In the receiving circuit as disclosed in Figure 1 of the accompanying drawings, I employ an untuned input circuit 1 for the first screened grid tube, two stages of tuned screened grid radio frequency amplification 2, an aperiodic untuned detector circuit 3, a stage of transformer coupled audio amplification 4, a second stage of resistance coupled audio amplification 5, a new grid and plate circuit 6 for the last tube and a special variable resistance 7 in the plate circuit 1 of the first tuned radio frequency stage.

In my untuned input circuit 1, I employ an inductance having a winding 8 of a relatively large number of turns of copper wire placed in close coupling with a differential winding 9 of high resistance wire, the two being connected serially, the winding 8 having one end thereof connected to the antenna 10 and grid circuit of the first radio frequency amplifier 11, and the winding 9 having its other terminal grounded.

The two stages of tuned screened grid radio frequency amplification 2 are coupled in the customary manner and tuned with variable condensers 12. The output of the plate circuit of

the tube 13 is fed into the aperiodic untuned circuit 3 of the detector 14.

Connected in series in the plate circuit of the tube 13 are two fixed resistances 15 and 16, the former of which is shunted by a fixed condenser 17. The coupling between this plate circuit and the grid circuit of the detector is effected by a coupling condenser 18 of large capacity. This condenser 18, in conjunction with the resistances 15, 16 and condenser 17, effectively block all feed back action into the plate circuit of the tube 13.

In the resistance coupled amplifier 5, I have provided a circuit that not only eliminates noises usually incident to pentode tube circuits, but I likewise eliminate costly by-pass and coupling condensers that heretofore have been of high capacity.

Connected in the plate circuit of the tube 19 is the usual plate resistor 20, shunted by a small fixed condenser 21. The coupling between this plate circuit and the grid circuit of the pentode tube 22 is effected by a relatively small fixed condenser 23 whereas ordinarily a .1 M.F. condenser is usually employed.

The grid circuit includes the usual fixed resistor 24 connected between the grid and ground and in my improved pentode tube circuit the cathode is grounded, while in the ordinary circuit a fixed resistance shunted by a large by-pass condenser with a capacity of approximately 8 M.F. is included in the cathode circuit to ground.

In my pentode tube plate circuit I have eliminated the usual impedance coil and blocking condenser in the speaker circuit and place the speaker 25 directly in the plate circuit.

As a result of these improvements in the pentode tube input and output circuits, I have been able not only to stabilize the tube but greatly improve its tonal qualities and increase the output current in the plate circuit.

In order that proper selectivity and volume control may be effected on local and distant stations, I have provided in the plate circuit 26 of the first screened grid radio frequency amplifier a variable resistance 27 and a fixed resistance 28, arranged serially. For local stations, with the switch arm on the contact 29, both of the resistances 27 and 28 are in the plate circuit and the voltage impressed on the plate is the minimum with a consequent reduction in plate current and volume at the speaker.

However, as the contact arm is moved to the contact 30, or a portion of the variable resistance is cut out of the circuit, then the plate voltage

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is increased with a consequent increase in sensitivity and volume.

The filaments of the various tubes are connected in parallel, without regulation of the filament current, in the conventional manner.

It is thus evident that in my new radio receiving apparatus, I have provided a circuit of extreme simplicity and of economical cost, yet possessing sharp tuning and selectivity without sacrificing purity of tone or volume.

When it is desired to operate the radio receiving apparatus from either alternating or direct current from the usual house lighting mains, I use the power supply and rectifier circuit. I employ, for use on alternating current, the usual power transformer 31 having a primary winding 32 across which is impressed the line voltage.

Secondary windings include the customary filament heater winding 33, rectifier filament heater winding 34, center tapped for the B+ connection, and a high voltage plate winding 35 for a full wave rectifier tube 36.

The leads to the primary winding 32 are connected to contacts 37 and 38 of my special six pole, double throw switch employed in connection with my power pack to use the latter with either alternating or direct current from 110 volt mains.

The leads from the heater winding 33 are connected to contacts 39—40 of this switch and the B+ lead to the center tapped winding 34 is connected with a contact 41, while the remaining contact 42 is connected to the grounded center tap of the rectifier tube plate winding 35 as a B— return.

Now, when my special six pole switch is in the position indicated by the full lines at Figure 2, the primary winding 32 will be connected with the source of supply through the switch blades 43—44 and leads 45—46, switch 47 and plug connections 48.

The filament heater windings 33 will be connected through the switch blades 49—50 with the filament contacts 51—52 on the multi-terminal receptor 53.

The B+ lead will be connected with the switch blade 54 and the grounded B— lead will be connected with the blade 55, both of which blades 54—55 connect through a conventional filter system 56 with the B+ and B— contacts 57—58 on the receptor 53.

It is thus seen that with the switch in the full line position as above described, I have a conventional "B" supply and rectifier system.

Now, with the switch in position indicated by the dotted lines for use with direct current from the usual house lighting mains, the supply leads 45—46 are connected through the switch blades 43—44 with contacts 59—60 as shown at Figure 2.

The contact 59 is now connected through the lead 61 with a switch contact 62 and through a lead 62^a with a switch contact 63, thus supplying A current to the filament contact 51 on the receptor 53 and B current to the contact 58.

The other contact 60, which is now connected with the + side of the supply circuit, is connected through a lead 64 with a contact 65 and the switch blade 54 through the filter system 56 to the B+ contact 57 on the receptor 53.

Another lead 66 from the lead 64 connects with the contact arm 67 of a variable resistance 68 whose other terminal connects with a switch contact 69 that is now engaged by the switch blade 50. This blade 50 as previously described is connected with the A+ terminal 52 on the receptor 53.

With the circuits thus arranged by my six pole change-over switch, I have completely eliminated the power transformer and rectifier tube from the circuit and I now impress the full line current of approximately 110 volts D. C. across the filter terminals and obtain a pure direct current across the B terminals 57—58 of approximately 107 volts.

My filament circuit across the contacts 51—52 is now supplied from the line current through the variable resistance 68, which, when once adjusted, requires no further attention. Although generator hum is still present in the filament circuit, it does not effect reception due to the indirect heater type tubes employed.

The terminal 70 on the receptor 53 is connected with the antennæ system, so that when the radio receiving apparatus as shown at Figure 1 is used with my supply pack it is only necessary to insert a multi-terminal plug 71 on the receiving apparatus to effect all necessary connections with the power system and antennæ.

Referring now to the drawings, in Figure 3 I have shown my receiving apparatus installed in a conventional console type cabinet 72 having a drawer-like compartment 73 in its lower portion to receive therein my receiving unit 74.

My receiving unit as shown at Figure 5 is of symmetrical shape and has accessibly positioned on the face thereof a usual tuning dial 75, volume control and filament switch 76, while upon its rear surface or back the multi-terminal plug 71 is supported to engage the receptor 53 secured in the back of the compartment 73 in the cabinet 72.

It is thus seen that to use my unit 74 in an automobile, it is only necessary to withdraw it from the compartment 73.

Mounted in the upper portion of the console or cabinet 73 is my power supply, shown diagrammatically at Figure 2, while a loud speaker (not shown) is housed in the end of my unit 74, behind the grille 77 in the side of the cabinet 72.

Now, when my unit 74 is used in an automobile as shown at Figure 4, it is received by a frame member 78 having an open front 79 and secured below the dash or cowl structure 80 of the car. This frame member 78 has a closed back 81 to which is secured another receptor 82 similar to the receptor 53, to which are attached the leads to the "A" battery, "B" battery and antennæ system, so that all electrical connections are made when the unit 74 is inserted in the frame member 78.

One end of the frame member 78 is open and covered with a suitable screen or grille 79 behind which the loud speaker is positioned in my unit 74.

It is thus seen that my compact, interchangeable radio receiving apparatus is readily adaptable to either automobile or home use without changing the wiring, tubes or other elements, and its universal application lends itself to a commercial field that heretofore has not been possible.

Having described my invention I claim:

A radio receiving apparatus including an alternating current rectifier circuit, a power transformer in said circuit, a primary winding in said transformer, a secondary filament heater winding a center tapped rectifier filament heater winding and a rectifier tube plate winding in said transformer, a positive B lead to the center tapped rectifier filament heater winding, a negative B return to the rectifier tube plate winding, terminals on a multi-terminal connector, a filter system, a variable resistance, a source of commercial alternating current or direct current, and a man-

ually operated multi-polar switch for connecting the primary winding of the transformer with a commercial alternating current supply, the positive B lead and the negative B return through the filter system with the positive B and negative B contacts of the multi-terminal connector and the filament heater winding with said connector, for alternating current operation, or for connect-

ing a source of commercial direct current supply through the filter system with the positive B and negative B contacts on the multi-terminal connector and with the positive A and negative A terminals of said connector to include the variable resistance in the positive A side of the filament circuit for commercial direct current operation.

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