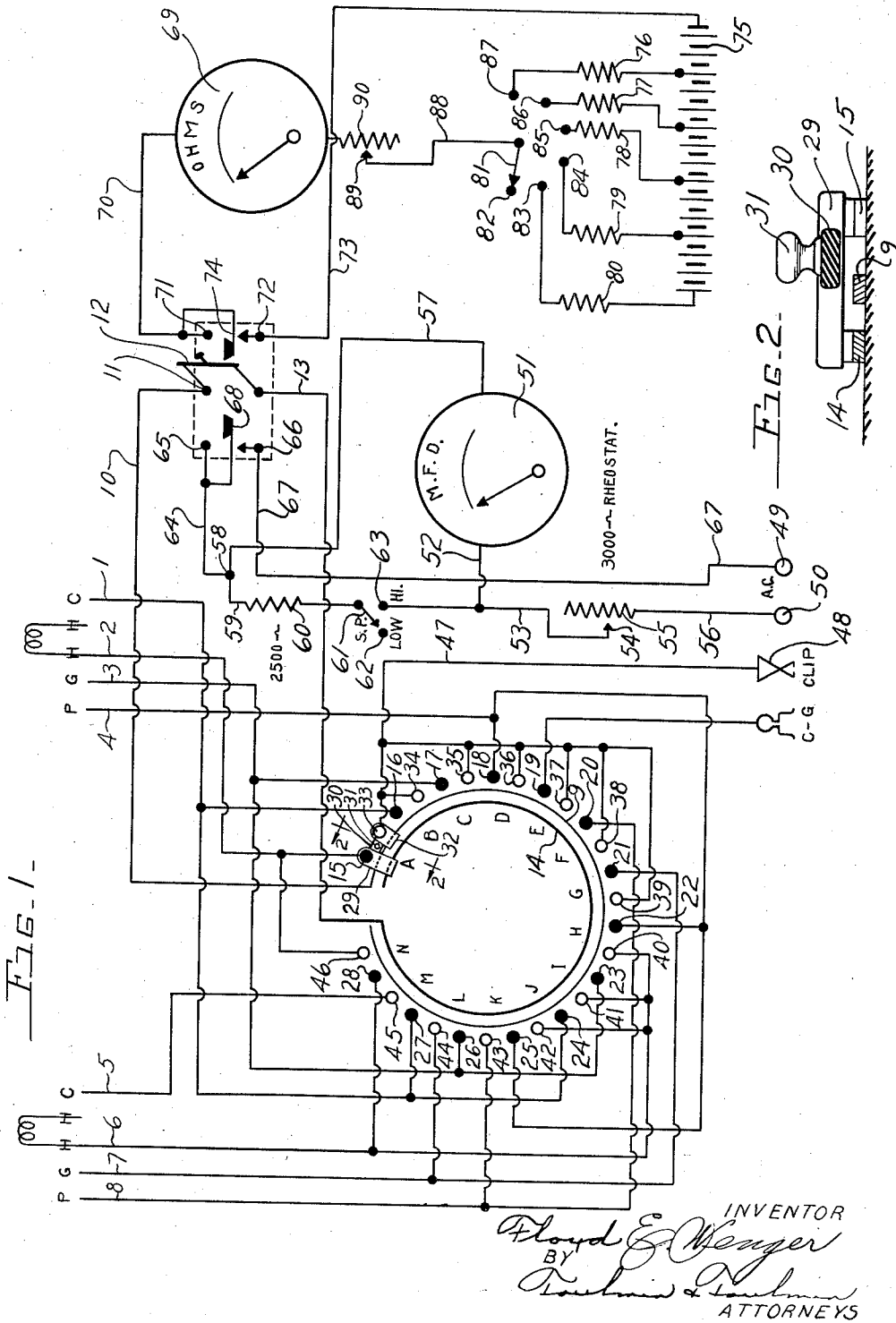


July 16, 1935.

F. E. WENGER
CONTINUITY AND CAPACITY TESTER FOR TESTING
RADIO RECEIVING AND TRANSMITTING SETS
Filed May 26, 1932

2,007,992



UNITED STATES PATENT OFFICE

2,007,992

CONTINUITY AND CAPACITY TESTER FOR
TESTING RADIO RECEIVING AND TRANS-
MITTING SETSFloyd E. Wenger, Bluffton, Ohio, assignor to R. L.
Tripiett, Bluffton, Ohio

Application May 26, 1932, Serial No. 613,669

13 Claims. (Cl. 250—20)

It is the object of my invention to provide an instrument for testing the various resistances, continuities, capacities and short circuits of an audion-tube circuit of any type.

My instrument is adaptable for tests either when the operating potentials are secured from a power-pack, batteries, generators, or other electro-motive sources in a circuit used for the receiving or sending of sound or sight signals, either by radio frequency waves or other means, or for any other purposes in which a vacuum or audion-tube circuit may be employed.

Referring to the drawing:

Figure 1 is a plan view of the wiring diagram.

Figure 2 is a section on the line 2—2 showing the arrangement of the switch for selecting the various terminals in the circuit for alternate testing purposes.

Referring to the drawing in detail, 1 represents the terminal wire in the right hand plug which is connected to a cathode, 2 indicates the filament wire, 3 the grid wire and 4 the plate wire.

The left hand plug has a cathode wire 5, filament wire 6, grid wire 7 and plate wire 8. The slide contact 9 is connected at one end through the wire 10 to the terminal 11 of the reversing switch 12. The other terminal of this switch is connected by the wire 13 to the inner slide contact 14. Bridging from the slide contact 14 to the terminals 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 and 28 is a cross over switch member 29. This switch member is connected by an insulated bar 30 having a handle 31 to a switch plate or finger 32 which engages the outside slide contact ring 9 and any one of the terminals, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45 and 46. By moving the two switch plates 29 and 32 as so described, it is possible to selectively test the radio set and its circuits as hereinafter described.

The line 47 is connected by the clip 48 to B—of the B supply, forming the ground or common terminal. The C—G clip is used to connect the control grid of tubes having the grid terminal of such shape to receive the clip, or to plates of a variable condenser, or any other desired connection.

The terminals 49 and 50 are connected to an alternating current source. The cycles and voltage of the source should correspond to the calibrations of the microfarad meter 51 which is connected by the wire 52 to the line 53 which terminates in the adjustable finger 54 engaging the resistance 55 which is connected by the wire 56 to the terminal 59. The other side of the meter

is connected by the line 57 to the terminal 58. This terminal is connected by the wire 59 through the resistance 60 to switch arm 61 which may engage the terminal 62 or the terminal 63 on the wire 53. The terminal 58 is connected by the wire 64 to the terminal 65 which is one terminal of the double pole, double throw switch 12, the other corresponding switch terminal 66 connects the wire 67 which terminates in the terminal 49. The wire 64 may be directly connected to the wire 67 by the push button 68.

The third phase of this invention comprises the following circuit and apparatus: A voltage ohm meter 69 which is connected on one side by the wire 70 to the double pole, double throw switch terminal at 71. The other terminal is designated 72 and is connected to the wire 73. The wires 73 and 70 may be connected together by the push button switch 74. The other end of the wire 73 is connected to a battery 75 which is tapped at intervals to resistances 76, 77, 78, 79 and 80. The free ends of the resistances are engaged by the switch arm 81 engaging with the terminals 82, 83, 84, 85, 86 and 87 respectively. The switch arm itself is connected by the wire 88 to an adjustable finger contact 89 engaging the resistance 90 which in turn is connected to the other terminal of the ohm meter 69.

It will be understood that the ohm meter 69 is so adjusted to correspond with the battery 75 or other similar electro motive source.

Operation

This instrument is capable of a large variety of tests, the principal ones of which are herein- after described.

When it is desired to test the continuity of a power circuit of the set, which means there is a test to be made from the power circuit to the voltage distribution net of the set circuit, the 40 tubes from the set to be tested are removed and the left hand plug comprising the wires 5, 6, 7 and 8 is placed in the rectifier socket, which has been formerly occupied by the rectifier tube. Successively plug the right hand plug comprising the wires 1, 2, 3 and 4 in each one of the remaining tube sockets of the set in order to make any one of the following tests. These tests are made by successively moving the switch plates 29 and 32 from the positions indicated at A, B, 50 C, D, E, F, G, H, I and J. For instance, in position A the contact finger 29 bridges the slide ring 14 and terminal 15 at the same time that contact member 32 bridges the slide ring 9 and the terminal 33. In position B the contact plate 55

29 bridges the slide ring 14 to terminal 16 and the contact plate 32 bridges the slide ring 9 to the terminal 34. In position C the terminals 17 and 35 are engaged. In position D the terminals 18 and 36 are engaged. In position E the terminals 19 and 37 are engaged. In position F the terminals 20 and 38 are engaged. In position G the terminals 21 and 39 are engaged. In position H the terminals 22 and 40 are engaged. In position I the terminals 23 and 41 are engaged. In position J the terminals 24 and 42 are engaged. In position K the terminals 25 and 43 are engaged. In position L the terminals 26 and 44 are engaged. In position M the terminals 27 and 45 are engaged. In position N the terminals 28 and 46 are engaged.

The following are the tests for each of these positions A to J when the left hand plug is in the left hand rectifier socket and the right hand plug is successively moving from socket to socket towards the rectifier socket in the set. Such tests are:

Position A.—Test the circuit condition and for defects between the usual heater contact and B—.

Position B.—Test the circuit condition and for defects in either the resistor or condenser from the usual cathode contact to B—.

Position C.—Test the circuit condition and for defects in either the resistor or condenser from the usual grid contact to B—.

Position D.—Test the circuit condition including the resistor and condenser between the usual plate contact and B—.

Position E.—Test for defective secondary tube coupling from the usual control grid to B—.

Position F.—Test for defects in one-half of the high voltage secondary winding of the power transformer from the rectifier plate contact to B—.

Position G.—Test for defects in the other half of the high voltage secondary winding of the power transformer, such as short circuits or open windings.

Position H.—Test for defects in the circuit from the filament contact of the rectifier tube to the plate contact of the amplifying or detector plate. Defects can be either short circuits or open windings.

Position I.—Test for defects from the high D. C. voltage side of the rectifying tube to the usual grid prong of the amplifying or detector tube.

Position J.—Test for defects from the high D. C. voltage of the rectifying tube to the usual cathode contact of the amplifying or detector tube.

When it is desired to test the degree of continuity between the same elements of different tube sockets, the right hand plug comprising the wires 1, 2, 3 and 4 is inserted in the radio frequency socket of the set and the left hand plug is inserted in the second adjacent socket. The left hand plug of the testing instrument comprises the wires 5, 6, 7 and 8. In other words, by placing the right hand plug in one amplifier socket, for instance, and placing the left hand plug in the next adjacent amplifier socket, the test is made for the degree of continuity between the same elements in the different sockets.

For this purpose set the switch plates 29 and 32 at position K and make the following tests at the successive positions K, L, M and N;

Position K.—Test for defects between the two plate contacts.

Position L.—Test for defects between the usual grid contacts.

Position M.—Test for defects between the usual cathode contacts.

Position N.—Test for defects between the usual heater contacts.

The defects so sought will be either a short circuit, open connection of wiring which should be repaired.

My invention is also capable of testing for open filter chokes, high resistance filter chokes, open speaker coils where they are used as filter coils, high resistance filter chokes, field coils when used as chokes, loose joints, high resistance joints, improper soldering, resistance of the voltage divider, the various resistances of the tube coupling transformers; measure the resistance of the resistance coupling circuits and measuring resistance of the transformer coupling circuits; measure the degree of continuity of one-half of the secondary of the power transformer to the usual tap of the power transformer, which is usually B—battery; measure the other half of that same high voltage secondary winding of the power transformer to its usual center tap.

By my invention is obtained a more accurate measure of the condition of the high voltage secondary than from a voltage measurement. It will measure the degree of the continuity from the plate contact of an audion tube to the heater contact of a rectifier tube—the heater contact of the rectifier tube usually furnishing very high D. C. potential.

The ohm meter also measures the degree of continuity from the usual cathode contact to the heater connection of the rectifier tube which is the high voltage connection.

By having the clip 48 connected to either B—battery or if B— returns to chassis, the resistance or the capacity is measured from the usual heater circuit to either B— or the chassis.

Ohm meter readings are also made covering the value of the cathode grid biasing resistor, the value of the cathode biasing resistor condenser, and resistance values of the entire voltage divider or any portion of the voltage divider terminating at a socket contact.

The test includes the entire secondary circuit for degree of continuity.

It will measure the degree of continuity from the usual plate contact of one tube circuit to the usual plate contact of any other tube within the circuit.

It will measure the degree of continuity from the usual grid contact of one tube to any other grid contact in the circuit.

This instrument can also be used for testing the capacity of the condensers connected in the radio circuit.

In order to measure the capacity of the condenser I follow the following procedure:

I first close the button 68 and adjust resistance 55 until the needle on the microfarad meter registers maximum. I then lift the button 68 and close the switch 12 on the terminals 65 and 66 adjacent the button 68 and thereby test the capacity of the condensers. It will be understood that A—C lines are connected to a suitable source of A—C current both as to cycles and voltage to match the meter. Thereafter, upon the closing of switch 12, I move my switch plates 29 and 32 on the collector rings to different positions in order to measure the different capacities in the circuit.

It will be understood that the finger 61 will be

moved from low to high position, or vice versa, according to the capacity of the condenser under test in the set so that the proper reading of the meter 51 may be secured.

Again, by closing the button 74 and adjusting the resistance 90 until the ohm meter registers maximum scale, then I open the button 74, close the switch 12 on the terminals 71 and 72 adjacent the button 74 and move the switch plates 29 and 32 on the collector rings to different positions to secure the various degrees of continuity in the circuits so bridged by the collector switch. The resistances 76 to 89 should be adjusted first for either battery current or rectified D—C current according to the resistor employed in the radio set so that the resistance selected will correspond to the resistor of the set and when the resistor in the set is tested the needle on the ohm meter when at maximum according to the resistances 76 to 89 as set can return in the reverse direction when testing value of the resistor in the set.

The purpose of this is to limit the amount of current that the resistor will register when tested on the scale of the instrument used.

It will be further observed that, when the switch 12 is closed on terminals 71 and 72 and the switch 21 is in "off" position engaging the contact member 82, then the rotating of the switch plates 29 and 32 on the slide wire selector switch will bring about different voltage readings between the different set connections on the ohm meter which will be used as a volt meter.

On the other hand, if the switch 12 engages the terminals 65 and 66 the same procedure can be employed for reading voltages on the microfarad meter 51. In this test the alternating current supply lines 56 and 67 would not be connected to the tester but the current would be taken from the set socket where the different voltages under test apply. This test is when the set is connected to its regular supply and is operated.

It will be understood that I desire to comprehend within my invention such modifications as may be necessary to adapt it to varying conditions and uses.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a tester, in combination, a plug having cathode, filament, grid and plate connections, each of which terminate in a plurality of contact members, a second plug having similar connections terminating in a plurality of contact members, said contact members being arranged in pairs, one from each plurality of contact members, selector switch slide rings adapted to be connected to a source of current through an indicating instrument, and switch plates adapted to connect said slide rings to pairs of said terminals.

2. In a tester, in combination, a plug having cathode, filament, grid and plate connections, each of which terminate in a plurality of contact members, a second plug having similar connections terminating in a plurality of contact members, said contact members being arranged in pairs, one from each plurality of contact members, selector switch slide rings adapted to be connected to a source of current through an indicating instrument, switch plates adapted to connect said slide rings to pairs of said terminals, other terminals connected to a source of potential.

3. In a tester, in combination, a plug having cathode, filament, grid and plate connections, each of which terminate in a plurality of contact

members, a second plug having similar connections terminating in a plurality of contact members, said contact members being arranged in pairs, one from each plurality of contact members, selector switch slide rings adapted to be connected to a source of current through an indicating instrument, switch plates adapted to connect said slide rings to pairs of said terminals, other terminals connected to a source of potential, such as the B— side of a B-battery.

4. In a radio testing set, a plug having cathode, filament, grid and plate terminals, a second plug having similar terminals, a plurality of contact members connected to said respective terminals, slide wires associated with said terminals having free ends thereof connected to a two-pole switch, and a microfarad testing circuit connected thereto by said switch, and means of supplying said microfarad testing circuit with a source of alternating current.

5. In a radio testing set, a plug having cathode, filament, grid and plate terminals, a second plug having similar terminals, a plurality of contact members connected to said respective terminals, slide wires associated with said terminals having free ends thereof connected to a two-pole switch, and a microfarad testing circuit connected thereto by said switch, and means of supplying said microfarad testing circuit with a source of alternating current, and a second switch adapted to complete said microfarad circuit when the slide wire switch is out of contact therewith.

6. In combination in a testing set, a plurality of plug circuits terminating in spaced terminals and connected to a pair of plugs, common slide wires associated with said terminals, switch means for connecting said slide wires to said terminals in pairs, said pairs including terminals of the same plug and terminals of different plugs, and a slide wire circuit adapted to be connected to a source of current through an indicating instrument.

7. In a tester, in combination, a set of plug circuits comprising cathode, filament, grid and plate terminals, a second set of plug circuits having similar terminals, a pair of slide wires adapted to be connected to a source of current through an indicating instrument, slide wire selector switches adapted to connect terminals of one set to the terminals of the other set.

8. In a tester, in combination, a testing circuit comprising a slide wire circuit and a plurality of plug circuits, a second circuit having a source of alternating current supply, a microfarad meter across said second circuit, and adjustable resistances in said second circuit, a switch adapted to open and close said second circuit and a second switch adapted to connect said circuits.

9. In a tester, in combination, a testing circuit comprising a slide wire circuit and a plurality of plug circuits, a second circuit having a source of alternating current supply, a microfarad meter across said second circuit, adjustable resistances in said second circuit, a switch adapted to open and close said second circuit, a switch in parallel with the meter, and switch means for connecting said second circuit into the slide wire circuit.

10. In a testing instrument, a testing circuit comprising a slide wire circuit and a plurality of plug circuits, a source of potential such as a battery, a plurality of resistance members tapped in at intervals in said battery, a selector switch for engaging said resistance members selectively, an ohm meter circuit connected to said switch, means to connect the ohm meter circuit to the

testing circuit, an adjustable resistance therein, an ohm meter therein, and means of closing said ohm meter circuit.

11. In a testing instrument, a testing circuit 5 comprising a slide wire circuit and a plurality of plug circuits, a source of potential such as a battery, a plurality of resistance members tapped in at intervals in said battery, a selector switch for engaging said resistance members selectively, 10 an ohm meter circuit connected to said switch, means to connect the ohm meter circuit to the testing circuit, an adjustable resistance therein, an ohm meter therein, means of closing said ohm meter circuit, and means of opening said 15 ohm meter circuit independently of the closing means.

12. In combination, in a radio testing set, a slide wire circuit, a plurality of plug circuits, a selector switch for connecting the plug circuits 20 into the slide wire circuit, a battery, a plurality

of resistances tapped at intervals into said battery, an ohm meter adapted to be selectively connected on one side to the resistances and connected on its other side to the battery, said battery, ohm meter, resistances and connections 5 forming a circuit, and means to connect the last-named circuit to the slide wire circuit.

13. In combination, in a radio testing set, a slide wire circuit, a plurality of plug circuits, a selector switch for connecting the plug circuits 10 into the slide wire circuit, a meter circuit, and means to connect the meter circuit into the slide wire circuit, said meter circuit, a battery, a meter connected on one side to one side of the battery and a connection from the other side of the meter 15 to the battery comprising a plurality of resistance members tapped into the battery at intervals, and a switch for engaging said resistance members selectively.

FLOYD E. WENGER. 20